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INFORMAL REPORT

**PHASE I SAMPLING AND ANALYSIS PLAN FOR
THE PBF EVAPORATION POND AND WASTE SUMP
(COCA UNITS PBF-08 AND PBF-10)**

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TABLE OF CONTENTS

| | | |
|---------|--|----|
| 1.0 | INTRODUCTION | 1 |
| 1.1 | <u>Background Information</u> | 2 |
| 1.2 | <u>General Site Description</u> | 2 |
| 1.3 | <u>Objectives of the Sampling Effort</u> | 2 |
| 2.0 | PROJECT DESCRIPTION | 5 |
| 2.1 | <u>Analysis of Existing Data</u> | 5 |
| 2.3 | <u>Data Quality Objectives</u> | 5 |
| 2.3.1 | <u>Decisions to be Made</u> | 6 |
| 2.3.2 | <u>Information Required to Make Decisions</u> | 6 |
| 2.3.3 | <u>Potential Consequences of Inadequate Environmental Data</u> | 7 |
| 2.3.4 | <u>Specific Environmental Data Required</u> | 7 |
| 2.3.4.1 | <u>Levels of Metals in Background Soils</u> | 7 |
| 2.3.4.2 | <u>Contaminant Levels in Site Sediments</u> | 7 |
| 2.3.5 | <u>Domain of Decision</u> | 7 |
| 2.3.6 | <u>Information to be Derived from Environmental Data</u> | 8 |
| 2.3.7 | <u>Need for New Environmental Data</u> | 8 |
| 2.3.8 | <u>Summary</u> | 9 |
| 2.3.8.1 | <u>Decisions to be Made</u> | 9 |
| 2.3.8.2 | <u>Resources Available for Data Collection</u> | 9 |
| 2.3.8.3 | <u>New Environmental Data</u> | 9 |
| 2.3.8.4 | <u>Domain of Decision</u> | 9 |
| 2.3.8.5 | <u>Data Analysis</u> | 9 |
| 3.0 | PROJECT ORGANIZATION AND RESPONSIBILITY | 12 |
| 4.0 | SAMPLING AND ANALYSIS STRATEGY | 15 |
| 4.1 | <u>Purpose</u> | 14 |
| 4.2 | <u>Biased Sampling Design</u> | 14 |
| 4.2.1 | <u>Waste Sump Biased Samples</u> | 15 |
| 4.2.2 | <u>Evaporation Pond Discharge</u> | 16 |
| 4.3 | <u>Systematic Random and Background Sample Design</u> | 16 |
| 4.4 | <u>Sample Analysis</u> | 18 |
| 4.5 | <u>Action Levels</u> | 19 |
| 5.0 | SAMPLING PROCEDURES | 22 |
| 5.1 | <u>Sample Collection</u> | 21 |
| 5.1.1 | <u>Waste Sump Biased Samples</u> | 21 |
| 5.1.2 | <u>Systematic Random and Background Samples</u> | 22 |
| 5.1.3 | <u>Evaporation Pond Biased Samples</u> | 23 |
| 5.2 | <u>Decontamination Procedures</u> | 23 |
| 6.0 | SAMPLE CONTROL AND DOCUMENT MANAGEMENT | 25 |
| 6.1 | <u>Documentation</u> | 25 |
| 6.1.1 | <u>Sample Container Label</u> | 25 |
| 6.1.2 | <u>Sample Container Tag</u> | 26 |
| 6.1.3 | <u>PBF Evaporation Pond and Sump Sample Numbering</u> | 26 |
| 6.1.4 | <u>Grid Sample Numbering</u> | 29 |
| 6.1.5 | <u>Field Guide Forms</u> | 29 |

| | | |
|---------|--|----|
| 6.1.6 | <u>Field Logbooks</u> | 29 |
| 6.1.6.1 | <u>Sample Logbook.</u> | 29 |
| 6.1.6.2 | <u>"Special" Logbooks.</u> | 31 |
| 6.1.6.3 | <u>Field Team Leader's Daily Logbook</u> | 31 |
| 6.1.6.4 | <u>Equipment Calibration and Decontamination Logbook.</u> | 31 |
| 6.2 | <u>Sample Handling</u> | 31 |
| | | 36 |
| 6.2.2 | <u>Transportation of Samples</u> | 40 |
| 6.2.3 | <u>Custody Seals</u> | 41 |
| 6.2.4 | <u>Field Radiation Screening Procedures</u> | 41 |
| 6.2.5 | <u>Onsite Shipping</u> | 43 |
| 6.2.6 | <u>Packaging of Radioactive Materials</u> | 43 |
| 6.2.7 | <u>Approvals Needed for Onsite Transportation of Samples</u> | 43 |
| 6.2.8 | <u>Shipping to Analytical Laboratories</u> | 43 |
| 7.0 | <u>EQUIPMENT</u> | 46 |
| 7.1 | <u>Maintenance and Operation</u> | 46 |
| 7.2 | <u>Calibration</u> | 46 |
| 7.3 | <u>Field Equipment</u> | 46 |
| 7.4 | <u>Laboratory Equipment</u> | 47 |
| 7.5 | <u>Decontamination</u> | 47 |
| 8.0 | <u>ANALYTICAL PROCEDURES</u> | 48 |
| 9.0 | <u>DATA REDUCTION, VALIDATION, AND REPORTING</u> | 53 |
| 9.1 | <u>Data Reduction</u> | 53 |
| 9.2 | <u>Data Validation</u> | 53 |
| 9.3 | <u>Reporting</u> | 54 |
| 10.0 | <u>QUALITY ASSURANCE</u> | 55 |
| 10.1 | <u>Field QA/QC</u> | 55 |
| 10.2 | <u>Laboratory QA/QC</u> | 55 |
| 10.3 | <u>Audits</u> | 57 |
| 10.3.2 | <u>Sample Collection Audits</u> | 59 |
| 10.3.3 | <u>Field Audits</u> | 59 |
| 10.3.4 | <u>Data Management Audits</u> | 60 |
| 10.4 | <u>Quality Assurance Reports to Management</u> | 61 |
| 11.0 | <u>QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY</u> | 62 |
| 11.1 | <u>Precision</u> | 62 |
| 11.2 | <u>Accuracy</u> | 62 |
| 11.3 | <u>Representativeness</u> | 63 |
| 11.4 | <u>Comparability</u> | 64 |
| 11.5 | <u>Completeness</u> | 64 |
| 12.0 | <u>SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS</u> | 65 |
| 12.1 | <u>Accuracy</u> | 65 |

| | | |
|-------------|--|----|
| 12.2 | <u>Precision</u> | 65 |
| 12.3 | <u>Completeness</u> | 65 |
| 13.0 | SAFETY AND TRAINING | 66 |
| 14.0 | REFERENCES | 67 |
| Figure 1-1. | Location of the PBF Reactor Area Evaporation Pond (PBF-733) and Corrosive Waste Disposal Sump (PBF-731). | 3 |
| Figure 3-1. | Organization Chart PBF Evaporation Pond Sampling and Analysis | 13 |
| Figure 4-1. | Systematic Random Sample GRid and the Arrangement of Spatial Composite Samples Within the Sample grid | 15 |
| Figure 6-1. | Sample container label. | 28 |
| Figure 6-2. | Sample container tag. | 28 |
| Figure 6-3. | Example of Field Guide Form. | 30 |
| Figure 6-4. | Media team activity log sheet | 32 |
| Figure 6-5. | Sample log sheet (page 1) | 33 |
| Figure 6-5. | Sample log sheet (page 2) | 34 |
| Figure 6-5. | Sample log sheet (page 3) | 35 |
| Figure 6-6. | Chain-of-custody form | 39 |
| Figure 6-7. | Packaging of environmental samples for shipment to the analytical laboratory | 42 |
| Figure 6-8. | Packaging of limited quantity radioactive samples for shipment to the analytical laboratory | 45 |

List of Tables

| | | |
|-----------|---|----|
| Table 2-1 | PBF EVAPORATION POND AND CORROSIVE WASTE SUMP DATA QUALITY OBJECTIVES | 11 |
| Table 4-1 | PBF EVAPORATION POND AND WASTE SUMP SAMPLE ANALYSIS SUMMARY | 15 |
| Table 4-2 | DOSE AND RISK CRITERIA | 20 |
| Table 6-1 | PBF EVAPORATION POND AND WASTE SUMP SAMPLE NUMBER SUMMARY | 27 |
| Table 6-2 | SAMPLE REQUIREMENTS - SOILS/SEDIMENTS/SLUDGE/BIOTA | 37 |
| Table 6-3 | SAMPLE REQUIREMENTS - AQUEOUS SAMPLES. | 38 |
| Table 8-1 | LOWER LIMITS OF DETECTION FOR SOIL SAMPLES | 50 |
| Table 8-2 | MINIMUM DETECTABLE ACTIVITY FOR SOIL | 51 |

ACRONYMS

| | |
|--------|---|
| AA | atomic absorption |
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing Materials |
| BNA | base neutral acid extractables |
| CCC | continuing calibration check |
| CERCLA | Comprehensive Environmental Response Compensation and Liability Act |
| CFR | Code of Federal Regulations |
| CLP | Contract Laboratory Program |
| COC | chain-of-custody |
| COCA | Consent Order and Compliance Agreement |
| CRQL | contract required quantification limit |
| DIRC | Data Integrity Review Committee |
| DOE | U.S. Department of Energy |
| DOE-HQ | DOE-Headquarters |
| DOE-ID | Idaho Operations Office of DOE |
| DRR | Document Review Request |
| EPA | Environmental Protection Agency |
| ERP | Environmental Restoration Program |
| ES&E | Environmental Sciences and Engineering |
| GC | gas chromatography |
| HP | health physics technician |
| ICP | inductively coupled plasma (spectrometry technique) |
| IH | industrial hygienist |
| IHT | industrial hygienist technician |
| INEL | Idaho National Engineering Laboratory |
| LDU | land disposal unit |
| LEL | lower explosive limit |
| MDL | Method Detection Limit |
| MS | mass spectroscopy |
| MSA | method of standard addition |
| MSE | Mountain States Energy |
| NIOSH | National Institute of Occupational Safety and Health |
| OMP | Occupational Medical Program |
| OSHA | Occupational Safety and Health Act |
| PBF | Power Burst Facility |
| PCB | polychlorinated biphenyl |

| | |
|-------|--|
| PI | principal investigator |
| PID | photoionization detector |
| PM | project manager |
| PPE | personal protective equipment |
| QA | quality assurance |
| QAO | quality assurance officer |
| QC | quality control |
| RCRA | Resource Conservation and Recovery Act |
| RESL | Radiological and Environmental Sciences Laboratory |
| RML | Radiation Measurements Lab |
| SAP | Sampling and Analysis Plan |
| SI | International System of Units |
| SOP | Standard Operating Procedure |
| SWMU | solid waste management unit |
| TOC | total organic carbon |
| TSDF | treatment, storage, and disposal facility |
| USGS | U.S. Geological Survey |
| USPCI | U.S. Pollution Control, Inc. |
| VOA | volatile organic analysis |
| VOC | volatile organic compound |

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) was prepared as part of the Environmental Restoration Program (ERP), RCRA Corrective Action Program at the Idaho National Engineering Laboratory (INEL). The Evaporation Ponds and the Waste Sump, located at the Power Burst Facility (PBF) Reactor Area, are considered Land Disposal Units under the Consent Order Compliance Agreement (COCA) and are being evaluated in accordance with the COCA requirements.

Sediment/sludge samples will be collected within the waste sump and surface samples will be collected from the sand placed above the hypalon liner in the evaporation pond. The intent of this plan is to determine if pond and sump sediments are Resource Conservation and Recovery Act (RCRA) Hazardous Waste, Class I Nonhazardous Waste, or Unregulated Materials. Data obtained from this sampling and analysis effort will determine the ultimate disposal of the materials found in the PBF Evaporation Pond and Sump. Resource Conservation and Recovery Act Hazardous Waste and Class I Nonhazardous Waste will be transported to a RCRA approved landfill. Unregulated waste does not require removal or special handling if removal is determined to be desirable.

This Sampling and Analysis Plan also functions as a Quality Assurance Project Plan (QAPP). The (QAPP) serves as a controlling mechanism during sampling and analysis to ensure that all data collected are valid, reliable, and defensible. This document outlines organization, objectives and Quality Assurance/Quality control (QA/QC) activities to achieve the desired data quality goals. The QA/QC requirements for this Project are detailed in the Data Collection Quality Assurance Plan (DCQAP) for the Buried Waste Program EGG-WM-8220, Rev. 1, dated 12/1/88. The DCQAP is a program plan and does not outline the site specific requirements for the Scope of Work covered by this Sampling and Analysis Plan (SAP).

1.1 Background Information

1.2 General Site Description

The Power Burst Facility Evaporation Pond (PBF-733) and Corrosive Waste Disposal Sump (PBF-731) are located southeast of the PBF Reactor building in the southern portion of the Idaho National Engineering Laboratory (Figure 1-1). From 1972 to January 1979, corrosive and chemical wastes from the facility were discharged through the sump to an injection well. From January 1979 to the latter part of 1984, the effluent was pumped to the evaporation pond.

The PBF Evaporation pond was constructed from soil material bermed to a height of 1.4 m (4.5 ft) with dimensions of 52 x 52 m (170 x 170 ft) at the top sloping to 43 x 43 m (140 x 140 ft) at the base. The pond bottom was graded to facilitate effluent flow to the center of the pond from an inlet pipe situated on the pond's west side. A sand layer ranging from 22.9 cm (9 in) at the base to 7.6 cm (3 in) along the walls was placed over the bermed material. A 0.08 cm (0.03 in) thick Hypalon liner was placed over the sand to seal the pond. Approximately 15.24 cm (6 in) of sand was then placed over the liner.

The effluent consisted of chromium-rich water from the reactor secondary cooling system, and sulfuric acid and sodium hydroxide from spent demineralization solutions. Approximately 209 kg of trivalent chromium, 16,300 kg of sulfuric acid and 18,300 kg of sodium hydroxide were discharged through the sump to the injection well or evaporation pond. Approximately half of this material was disposed of in the injection well (1972-1979) and the remainder was discharged to the evaporation pond (1979-1984).

1.3 Objectives of the Sampling Effort

Previous sampling and analysis efforts at the PBF Evaporation Pond have indicated the presence of low concentrations of radionuclides. Additionally, effluent discharge to the pond suggests contamination by chromium could be

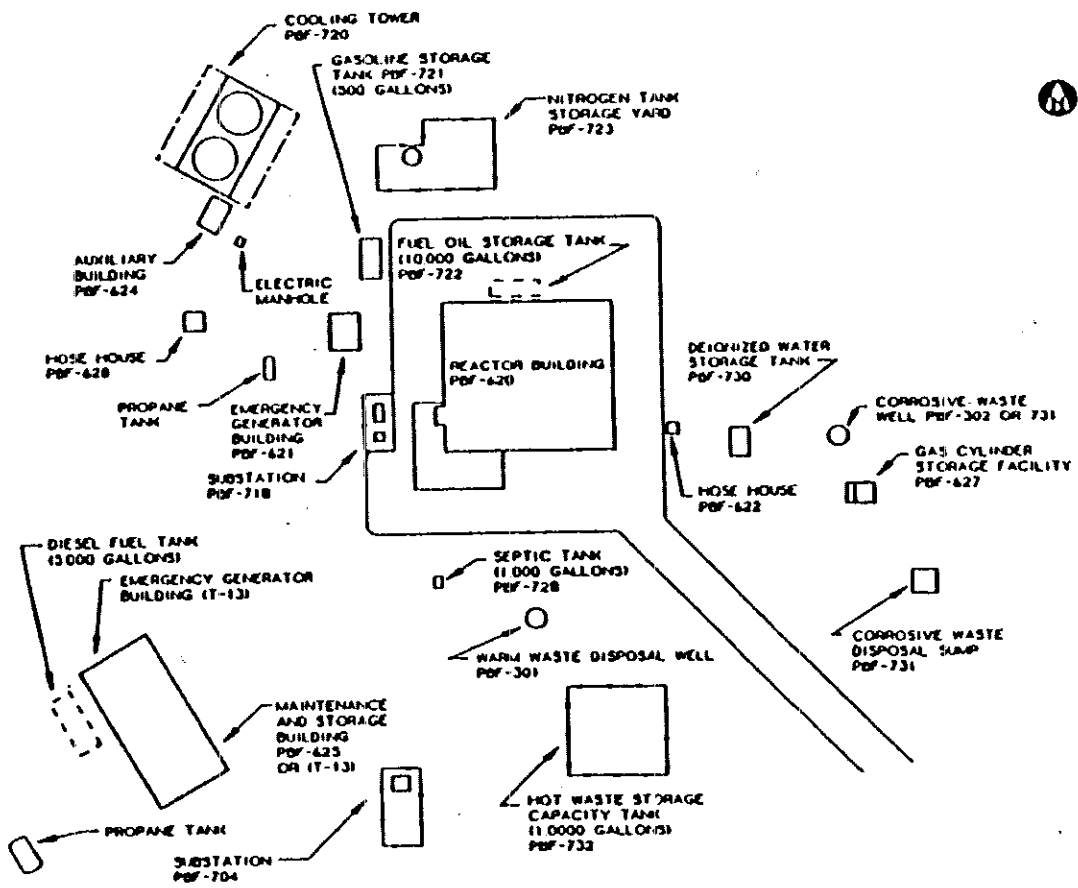


Figure 1-1. Location of the PBF Reactor Area Evaporation Pond (PBF-733) and Corrosive Waste Disposal Sump (PBF-731).

significant. The project objective is to assess the levels of metal and radionuclide contamination within the sediment contained in the PBF Reactor Area Evaporation Pond (PBF-733) and the PBF Corrosive Waste Disposal Brine Tank (PBF-731) at the Idaho National Engineering Laboratory. Analytical results from the samples will be used to assess the pond and sump sediments for proper waste disposal.

2.0 PROJECT DESCRIPTION

2.1 Analysis of Existing Data

A previous investigation in 1987 sampled and analyzed the Evaporation Pond sediments for organic and inorganic contamination. The analyses performed included: ICP metals (EPA method 6010), volatile organics (EPA method 8240), semi-volatiles (EPA method 8270), and pesticides and PCBs (EPA method 8080). Results of the inorganic analyses did not pass quality assurance requirements and were considered unreliable. The organic analyses detected several compounds at levels near detection limits and the presence of these same compounds in associated laboratory blanks suggested that detection was due to laboratory contamination. The conclusion for this investigation was that Evaporation Pond sediments contained no significant organic contamination based on the reliable organic data. Sample collection, shipment, and analysis for this investigation strictly followed EPA protocols.

The PBF Evaporation Pond was sampled for gamma emitting radioisotopes in September of 1989. A total of six samples were collected and analyzed by gamma spectroscopy at the INEL, Radiation Measurements Laboratory (RML). Samples were collected at the pond discharge adjacent to the drip pan, diagonally across the pond from the drip pan and at two background locations. Analysis results indicated ^{137}Cs was present in concentrations that exceeded Radiological Release Criteria for Soils (EG&G, 1986). Specific concentrations ranged from a high of 830 pCi/g for a surface sediment sample collected adjacent to the drip pan to a low of 15.2 pCi/g collected diagonally across the pond from the drip pan. Radiological Release Criteria specify a limit of 10 pCi/g for release of soils contaminated by ^{137}Cs . All other radionuclides were present at concentrations below Radiological Release Criteria.

2.3 Data Quality Objectives

The Phase I Sampling and Analysis Plan is based upon Data Quality Objectives that were developed as outlined below.

2.3.1 Decisions to be Made

The Environmental Sciences and Engineering Unit and ERP Program Managers, with concurrence from EPA Region 10 and the Idaho Hazardous Waste Bureau, will determine if the PBF evaporation pond can achieve clean closure without remedial actions or additional environmental sampling and analysis. If Phase I sampling and analysis indicates that clean closure cannot be achieved without remedial actions and/or additional sampling, a Phase II sampling and analysis effort will be initiated following the removal and appropriate disposition of the evaporation pond sediments and liner.

The information generated by the sampling plan will also be used to support one of two decisions concerning the corrosive waste sump. If contamination is not detected, negotiations for clean closure status will be made. If contamination is found within the sump, a Phase II sampling and analysis effort will be initiated following remedial actions.

2.3.2 Information Required to Make Decisions

The clean closure decision for the PBF Evaporation Pond and Waste Sump will be based upon the concentration present or absence of contaminants in the sediments of that area. Contamination due to metals, organics or radionuclides may be present. To make site closure decisions, contaminant levels in evaporation pond and sump sediments are compared to action limits. If contaminant levels exceed action limits clean closure of the evaporation pond and sump may not be possible. A decision against clean closure of the sump could lead to remedial actions and Phase II sampling to determine the extent of contaminant migration from the sump, or to verify the presence or absence of further contamination following remedial actions. A decision not to clean close the evaporation pond would prompt liner and sediment removal followed by phase II sampling.

2.3.3 Potential Consequences of Inadequate Environmental Data

Environmental data that is not truly representative of either background soils, the evaporation pond sediments, or the corrosive waste sump sediments could lead to incorrect site closure decisions. Data that indicates the presence of sediment contamination when none actually exists would unnecessarily trigger both the removal and disposal of the sediment and Phase II sampling and analysis. The result would be an over-expenditure of available human and financial resources. Conversely, data that incorrectly indicated a lack of contamination would result in the premature clean closure of the site and a failure to address an existing contamination problem.

2.3.4 Specific Environmental Data Required

2.3.4.1 Levels of Metals in Background Soils. Statistically representative surface soils from the general site area must be sampled and analyzed to determine naturally-occurring levels of metals. Metal levels in background samples provide a basis for evaluating contamination.

2.3.4.2 Contaminant Levels in Site Sediments. Statistically representative samples of pond and sump sediments must be analyzed to determine radionuclide and metal concentrations. Concentrations of metals and radionuclides are compared to action levels to demonstrate the presence or absence of contamination.

Specific analyses of the sediments will consist of: ICP metals, metals for EP toxicity, pH, Appendix IX, and gamma emitting radioisotopes by gamma spectroscopy.

2.3.5 Domain of Decision

The Phase I Sampling Plan specifically addresses the PBF Evaporation Pond and Waste Sump. Actions resulting from the evaluation of Phase I data will impact the evaporation pond area itself, and, if a decision is made to initiate Phase II sampling, the land immediately adjacent to the pond as well.

Land adjacent to the pond would be impacted to facilitate removal of the pond liner and contaminated material above the liner, and to assess the affects of wind blown contamination. Actions resulting from the evaluation of Phase I data will impact the sump and a small area surrounding the sump. Should visual inspection during the Phase I sampling effort or remedial actions indicate contamination of soils adjacent to the sump is probable, additional disturbance may result from sump remediation, soil sampling, removal of contaminated soil, and Phase II sampling for closure verification.

2.3.6 Information to be Derived from Environmental Data

Laboratory data resulting from the Phase I sampling and analysis effort will be evaluated to determine if contamination exceeds background levels and/or EP toxicity limits, and if radionuclide contamination exceeds Radiological Release Criteria (EG&G, 1986). Appendix IX samples will be used to screen for a broad array of contaminants in the sump sediments. Sampling and analysis information will be used to determine site closure options.

2.3.7 Need for New Environmental Data

Evaporation pond sediments were sampled and analyzed for organic and inorganic contamination in 1988. The resulting inorganic data was subsequently judged to be unusable due to its failure to meet CLP recommendations. Consequently, new data that meets appropriate quality assurance criteria must be generated to meet RCRA data requirements.

Gamma spectroscopy analysis of evaporation pond sediments performed in 1989 detected elevated levels of some radioisotopes in the pond sediments. Additional sampling is necessary to verify the presence of these radionuclides and to determine areal extent of contamination. Additionally, pond sediments must be characterized to determine RCRA closure options available for remedial actions and to evaluate disposal options for material above the liner.

The corrosive waste sump sediments have not been sampled to date. Information regarding past usage of the sump indicates that a potential for

contamination by metals and/or radionuclides exists. Knowledge of construction of the sump, also indicates there is potential for migration of contaminants from the sump to the surrounding soil. Analytical data from sump sediments is required to determine appropriate closure options available. Localized background data is also needed at this site, since none is currently available.

2.3.8 Summary

Table 2-1 summarizes the Data Quality Objectives (DQOs) for this sampling and analysis effort.

2.3.8.1 Decisions to be Made. Does the PBF Evaporation Pond and Corrosive Waste Sump qualify for clean closure with no additional sampling and analysis or remedial actions? What remedial actions are dictated by the waste characterization resulting from analysis of the sediment samples collected from the sump and pond? What subsequent data is required to support remediation and closure activities?

2.3.8.2 Resources Available for Data Collection. Financial resources necessary for data collection are not considered to be the major limiting factor. Weather conditions, time, and human resources are expected to be the limiting factors.

2.3.8.3 New Environmental Data. The evaporation pond and waste sump sediments must be sampled and analyzed to determine if contamination by metals and/or radionuclides is present. Background data is also needed for comparative and planning purposes.

2.3.8.4 Domain of Decision. Only the PBF Evaporation Pond, Waste Sump, and perhaps some relatively small areas adjacent to the pond and sump, will be impacted by this decision.

2.3.8.5 Data Analysis. Biased, composite surface soil samples will be obtained from five selected background locations near the site. Those samples

will be analyzed for ICP metals. Fifteen systematic random, composite samples of evaporation pond sediments and five biased samples will be collected; those samples will be analyzed for ICP metals, EP toxicity metals, and radionuclides. Two grab samples will be collected from sump water and sediments. Those samples will be analyzed for 40 CFR Appendix IX analytes and gamma emitting radionuclides.

2.3.8.6 Action Based on Data. If statistically reliable data indicates that metals and radionuclides are present in the sediments at levels above action limits, the sediments will be considered contaminated. Action limits for radionuclides will be based upon Radiological Release Criteria for Soils (EG&G, 1986). Action limits for organics will be set at twice the Method Detection Limit (MDL).

Table 2-1. PBF EVAPORATION POND AND CORROSIVE WASTE SUMP DATA QUALITY OBJECTIVES.

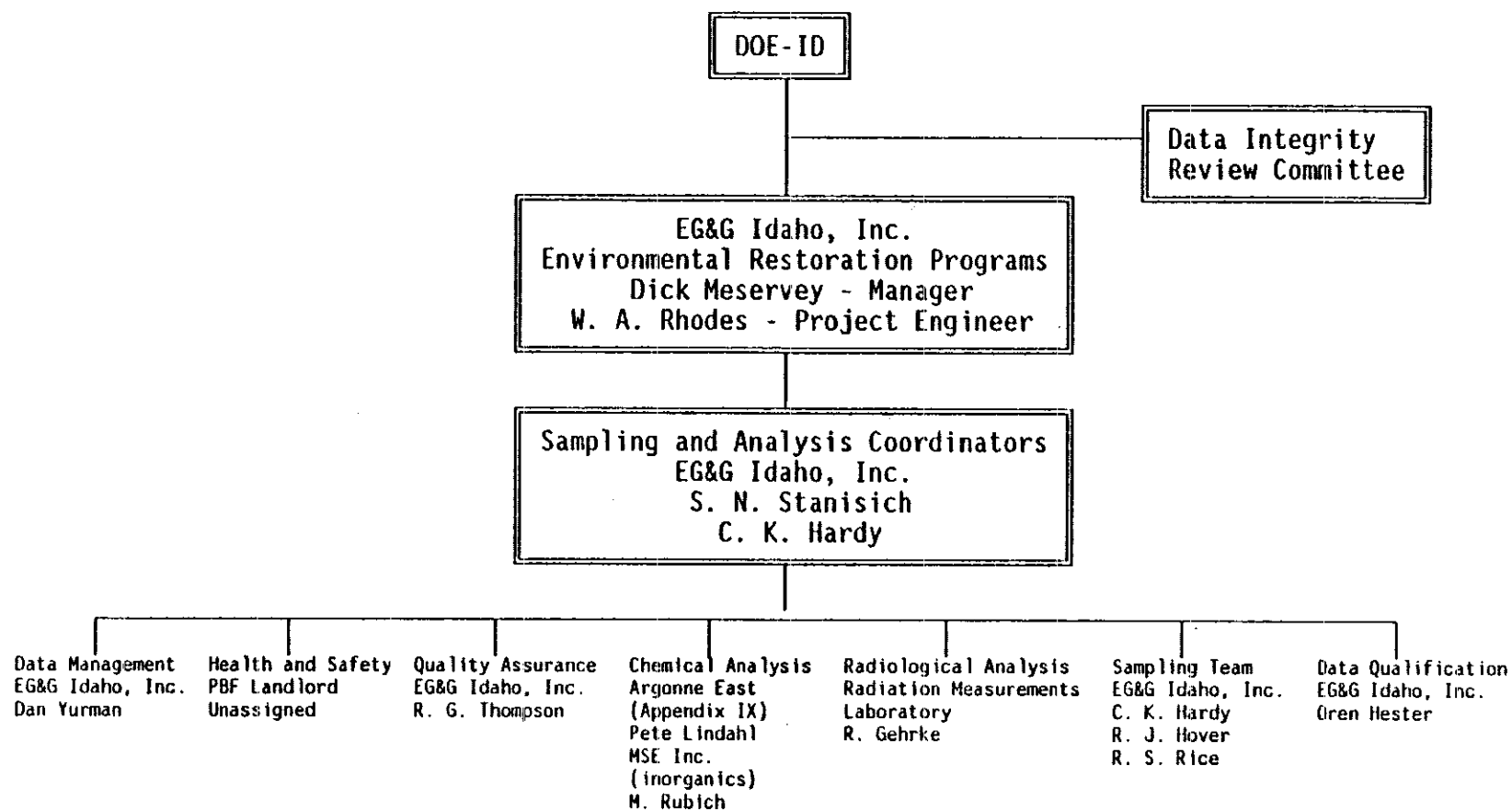
| LOCATION: | WASTE SUMP | EVAPORATION POND | BACKGROUND |
|---------------------------------|---|--|--|
| ACTIVITY | Obtain biased grab samples of corrosive waste sump sediments for Appendix IX and radionuclide analysis. Additionally, samples will be collected adjacent to the sump for ICP metals, and radionuclide analysis. | Obtain systematic random samples for ICP metal, EP Tox., pH and radionuclide analysis. Obtain biased samples for ICP metal and radionuclide analysis. | Obtain biased composite surface samples from undisturbed native range from selected background soil locations adjacent to the PBF facility, and analyze the samples for ICP metals |
| OBJECTIVE | Determine the presence of Appendix IX, and radionuclide contamination in the sump sediments. Determine if contaminant leakage from the sump has occurred. | Determine the presence and areal extent of metals and radionuclide contamination in the evaporation pond sediments | Determine the background levels of metals for comparison with potentially contaminated sediments and soils in the sump and evaporation pond. |
| PRIORITIZED DATA USE | Evaluate RCRA closure options, determine need for Phase II sampling and analysis of soils and sediments. | Evaluate RCRA closure options and determine the need for Phase II sampling and analysis | Provide basis for evaluating contamination levels in waste sump and evaporation pond sediments and soils. |
| II APPROPRIATE ANALYTICAL LEVEL | Level III | Level III | Level III |
| CONTAMINANTS OF CONCERN | Appendix IX analytes, radionuclides and metals | metals, radionuclides, EP Toxicity | metals and sulfides |
| LEVEL OF CONCERN | METALS: 95% upper one-tailed confidence interval from background samples ORGANICS: 2 x MDL RADIONUCLIDES: greater than radiological release criteria, USPCI Acceptance Criteria and Mixed Waste Criteria | METALS: 95% upper one-tailed confidence interval from background samples ORGANICS: 2 x MDL RADIONUCLIDES: greater than radiological release criteria, USPCI Acceptance Criteria and Mixed Waste Criteria | N/A |
| REQUIRED DETECTION LIMIT | METALS: MDL ORGANICS: MDL RADIONUCLIDES: MDL | METALS: MDL RADIONUCLIDES: MDL | METALS: MDL |
| CRITICAL SAMPLES | 90% Target Completeness Level | 90% Target Completeness Level | 90% Target Completeness Level |

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Several organizations will be directly involved in the performance and review of this project. The project documentation receives internal review which is outlined in the Environmental Restoration Program (ERP), Program Directive for the Preparation of Sampling and Analysis Plans. An organization chart for sampling and analysis activities at the PBF Evaporation Pond and Waste Sump is shown in Figure 3-1.

The key personnel designated to prepare all plans and conduct work required for this project include:

- Mr. Nick Stanisich will be the Task Project Manager during sampling and analysis and subsequent RCRA Closure efforts at the PBF Evaporation Pond and Waste Sump. He will be responsible for directing the project team, reviewing and editing project documentation and for communicating with the Decontamination and Decommissioning Program, Environmental Restoration Program, Data Integrity Review Committee (DIRC), DOE-ID, EPA Region X and the contract laboratory on logistical, technical and administrative matters.
- Mr. Charles Hardy will function as a sampling and analysis coordinator. He will be responsible for writing and editing of the sampling and analysis plan, review of project documentation and will serve as a Field Team Member during sampling and analysis.
- Mr. Randy Rice and Mr. Ron Hover along with other personnel will serve as Field Team Members. They will assist in all phases of planning, documentation, editing, and review, as well as field sampling, sample shipping, laboratory liaison, data reduction and evaluation.



Sampling and Analytical Team Organization

Figure 3-1. Organization Chart - PBF Evaporation Pond Sampling and Analysis.

4.0 SAMPLING AND ANALYSIS STRATEGY

4.1 Purpose

Previous sampling and analysis efforts at the PBF Disposal Ponds have confirmed the presence of radionuclide and metal contaminants. Contaminants are present in levels above the range of naturally occurring background concentrations. A combination of biased and systematic random sampling will be employed to facilitate characterization of pond and sump sediments in order to determine RCRA closure options available for these sites.

4.2 Biased Sampling Design

Biased samples will be collected in the waste sump, from background soils adjacent to the pond and sump, from pond sediment adjacent to the point of effluent discharge into the evaporation pond (i.e. around the "splash-pan"), and other "hot-spots" identified during the preliminary instrumental field survey of the pond sediment.

Table 4-1 summarizes sampling and analysis for the PBF Evaporation Pond and Waste Sump. Biased samples are based on radiological field surveys. The assumption is that the higher concentrations of metals will be present in the areas of greater radiologic activity. Collecting biased samples is a conservative approach which can be used to estimate the maximum level of contamination.

4.2.1 Waste Sump Biased Samples

Biased samples will be collected from the corrosive waste sump. Two grab samples will be collected using an inert one liter teflon sampler, and will be analyzed for Appendix IX analytes and by gamma spectroscopy. Presently, the sump has not been sampled for contaminants. The waste stream to the evaporation pond passes through the sump, making it a logical target for contaminant accumulation. Therefore, 40 CFR Part 264 Appendix IX analysis, and gamma spectroscopy will be used to characterize the sump.

Table 4-1. PBF EVAPORATION POND AND WASTE SUMP SAMPLE ANALYSIS SUMMARY.

| | | | | EPA Methods Number | | | | | | | | | |
|-----------------------|-------------------|-------------------|-----------------------------|--------------------|----------|---------|-----------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------|
| I-CHM Jar Size | | | | 250 ml | 125 ml | | 40 ml | 125 ml ^a | 250 ml ^b | 250 ml ^c | 250 ml ^d | 125 ml ^e | 16 oz. |
| Location | Number of Samples | Sampling Method | Sample Type | 1310 EP Tox | 6010 ICP | 9045 pH | 8240 VOAs | Appendix IX | | | | | RML-3 Gamma-Spec. |
| Evaporation Pond | 15 | Spatial Composite | Systematic Random, Sediment | 15 | 15 | 15 | | | | | | | 15 |
| Pond Biased | 5 | Grab | Biased, Sed. | | 5 | | | | | | | | 5 |
| Pond Replicates | 2 | Spatial Composite | QC, Sediment | 2 | 2 | 2 | | | | | | | 2 |
| Waste Sump | 2 | Beaker | Biased, water | | | | | 2 | 2 | 2 | 2 | 2 | 2 |
| Waste Sump | 2 | Beaker | Biased, Sed. | 2 | | | | | | | | | 2 |
| Rinsates ^f | 2 | | QC, water | | 2 | | 2 | | | | | | 2 |
| Trip Blank | 1 | | QC, water | | | | 1 | | | | | | |
| Field Blank | 2 | | QC, water | | 2 | | 2 | | | | | | 2 |
| Background Soils | 5 | Spatial Composite | Biased, Sed. | | 5 | | | | | | | | |
| Totals | | | | 17 | 33 | 17 | 5 | 2 | 2 | 2 | 2 | 2 | 30 |

a. Analytical parameters: Volatile organics/Hydrocarbons

b. Analytical parameters: Semivolatile organics

c. Analytical parameters: Herbicides/Pesticides

d. Analytical parameters: PCBs

e. Analytical parameters: ICP metals/Cyanide/Pb/Hg/As/Sn/Tl/Sulfides

f. Rinsates analyzed only for ICP metals (6010) and VOAs (8240)

Additionally, five biased background samples will be collected from undisturbed soils adjacent to the waste sump/pond locations, but away from prevailing winds, to establish baseline data for analyte species. These samples will be collected using a stainless steel hand auger and analyzed for ICP metals and by gamma spectroscopy.

4.2.2 Evaporation Pond Discharge

Biased surface sediment samples will also be taken in the immediate vicinity of the pond discharge point. The discharge pipe to the evaporation pond is elevated about 1.5 m above the bottom of the pond. Discharge pours onto a metal splash-pan and is dispersed into the pond sediments. Sampling performed in September of 1989 detected elevated levels of radionuclides in the sediments adjacent to the splash-pan. Discharge pipe biased sampling is designed to collect samples adjacent to the splash-pan to confirm or refute the presence and assess the areal extent of radionuclide contamination. Radionuclide contamination is thought to be highest in the vicinity of the splash-pan. Five field survey selected biased samples will be collected using a hand auger. Specific sample locations will be biased in the field using portable radiation detection equipment. Samples will be analyzed for ICP metals (EPA method 6010) and by gamma spectroscopy.

4.3 Systematic Random and Background Sample Design

Systematic random samples will be collected from the evaporation pond to determine the presence and areal extent of metals and radionuclide contamination and to determine if the sediments exhibit characteristics of EP Toxicity. The evaporation pond measures 42.7 x 42.7-m. Each side of the pond will be divided into seven segments of equal length (6.1 m). A grid system with a total of 49 cell will be created. Fifteen systematic random samples will be collected from the 6.1 x 6.1-m (20 x 20-ft) grid system placed over the evaporation pond (Fig. 4-1). Within the 15 cells randomly selected for

PBF Waste Disposal Evaporation Pond Grid System

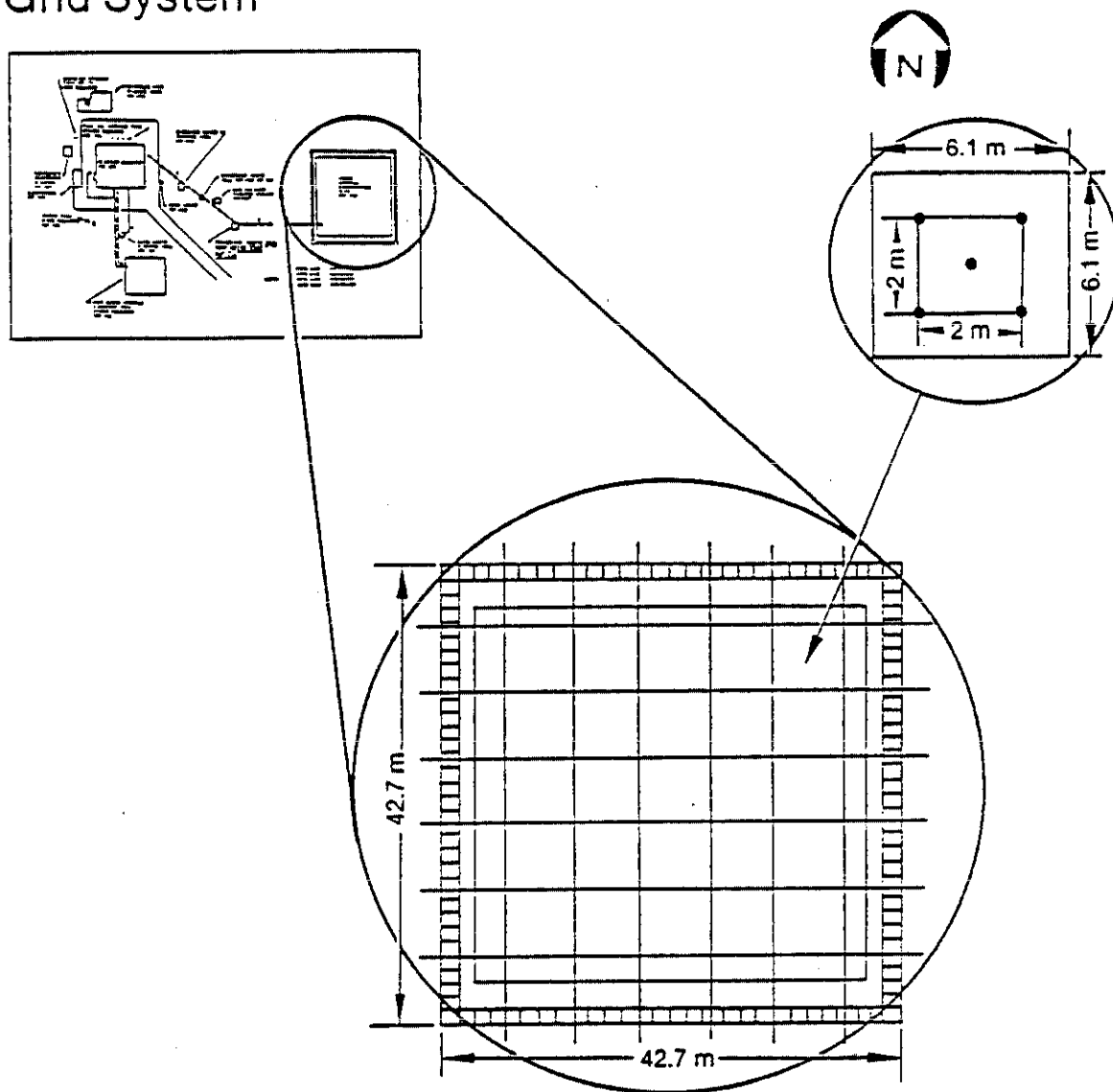


Figure 4-1. Systematic random sample grid and the arrangement of spatial composite samples within the sample grid.

sampling, a spatial composite comprised of five subsamples will be collected. The five subsamples will be collected from the center point and the four corners of a 2 x 2-m sample plot. The subsample plot will be located at the approximate center of the 6.1 x 6.1-m grid block. Figure 4-1 shows the relation of the subsample plot to the pond grid. Table 4-1 summarizes sampling and analysis for the systematic random samples. Systematic random samples from the evaporation pond will be analyzed for ICP metals, pH, EP Toxicity and by gamma spectroscopy.

Background samples will be collected using a hand auger and the same spatial compositing scheme used to collect systematic random samples. Subsamples will be collected from the surface 0-15 cm of soil.

4.4 Sample Analysis

Corrosive waste sump biased samples will be analyzed for 40 CFR Part 264 Appendix IX analytes and by gamma spectroscopy. Biased soil samples taken adjacent to the waste sump and the biased discharge pipe samples will be analyzed for ICP metals (EPA method 6010) and by gamma spectroscopy. Systematic random samples will be analysed for metals by ICP (EPA method 6010), pH (EPA method 9045), EP Toxicity (EPA method 1310) and by gamma spectroscopy for gamma-emitting radionuclides. Analyses with EPA method numbers will be analyzed according to guidelines specified in SW-846 (Test Methods for Evaluating Solid Waste). Specific analyses used to determine Appendix IX analytes are described in Section 8. Analytical procedures for gamma spectroscopy can be found in SOPs for the INEL, Radiation Measurements Laboratory (RML). Appendix IX samples and associated trip blanks will be sent to Argonne East, Chicago, Illinois for analysis and all other samples will be sent to Mountain States Energy (MSE) Inc., Butte, Montana for analysis

Quality Control (QC) samples will also be collected during evaporation Pond sampling and analysis (Table 4-1). Rinsates (equipment blanks), field blanks, trip blanks and field replicates will be provided. Sections 10.1 and 11 describe project QC samples in more detail.

Background samples will be analysed for ICP metals (EPA method 6010). The purpose of background samples is to determine action levels for metals. Volatile organic analysis and analysis by gamma spectroscopy is not performed on background samples. Action levels for these parameters are defined using other criteria.

4.5 Action Levels

Action levels for contaminants in the surface and subsurface soils at the PBF Evaporation Pond and Sump are set using a variety of criteria for organics, metals and radionuclides. Action levels for radionuclides in soils can be established by using Radiological Release Criteria for Soils as presented in the *Development of Criteria for Release of Idaho National Engineering Laboratory Sites Following Decontamination and Decommissioning* (EG&G, 1986). These guides are presented in Table 4-2. The guidelines are very conservative. The decommissioning criteria assume the sites will be used for agricultural purposes (farming scenario). The release criteria are consistent with current international (International Commission on Radiological Protection) and national (National Commission on Radiological Protection) thinking about radiation.

The action level for organics will be set at twice the Method Detection Limit (MDL). Organic contaminants detected at the disposal pond do not occur naturally and are not analysed for in background samples. The twice the MDL action level is an arbitrary level used to account for the lack of naturally occurring organic contaminants, while remaining as conservative as possible by addressing contaminant levels at the lower limit of analytical reliability.

Action levels for metals in soils will be set at the 95% upper one-tailed confidence interval of the background samples. The data collected for metals will be used to calculate analyte specific means and 95% one-tailed upper confidence intervals. The 95% upper one-tailed confidence interval for inorganics found in background samples will be defined as the action limit. Discreet comparisons to background action levels for each inorganic will be made. If inorganic constituents detected during evaporation pond sampling and

Table 4-2. DOSE AND RISK CRITERIA

| Radionuclide | Concentration (pCi/g) ^a in Soil Corresponding to an Effective Dose Equivalent of 100 mrem in First Year after Release |
|-------------------|---|
| ⁵⁴ Mn | 1 x 10 ¹ |
| ⁵⁷ Co | 2 x 10 ² |
| ⁵⁸ Co | 3 x 10 ¹ |
| ⁶⁰ Co | 4 x 10 ⁰ |
| ⁹⁰ Sr | 5 x 10 ¹ |
| ¹⁰⁶ Ru | 6 x 10 ¹ |
| ¹²⁵ Sb | 2 x 10 ¹ |
| ¹²⁹ I | 2 x 10 ² |
| ¹³⁴ Cs | 6 x 10 ⁰ |
| ¹³⁷ Cs | 1 x 10 ¹ |
| ¹⁴⁴ Ce | 3 x 10 ² |
| ¹⁵² Eu | 1 x 10 ¹ |
| ¹⁵⁴ Eu | 7 x 10 ⁰ |
| ¹⁵⁵ Eu | 4 x 10 ² |
| ²²⁷ Ac | 7 x 10 ⁰ |
| ²³² U | 3 x 10 ⁰ |
| ²³³ U | 4 x 10 ² |
| ²³⁴ U | 4 x 10 ² |
| ²³⁵ U | 6 x 10 ¹ |
| ²³⁸ U | 2 x 10 ² |
| ²³⁸ Pu | 3 x 10 ² |
| ²³⁹ Pu | 3 x 10 ² |
| ²⁴⁰ Pu | 3 x 10 ² |
| ²⁴¹ Pu | 1 x 10 ⁴ |
| ²⁴¹ Am | 8 x 10 ¹ |

a. Assumes uniform contamination of an area adequate for subsistence farming and the behavior and consumption patterns specified in the farming scenario.

analysis are found to be below these action levels then the site will be considered free of this particular analyte. Detections above action limits indicate RCRA cleanup activities may be necessary or additional sampling to improve site characterization is required. The soil collected for background data will have the same eolian deposits (near the surface) as those found in the pond. The sand at the bottom of the pond is of unknown origin, however, and could show different background characteristics in its natural state than the soil near the site. Background soil samples collected out of the path of the prevailing winds are the best estimates available for this SAP.

5.0 SAMPLING PROCEDURES

5.1 Sample Collection

Sampling procedures have been developed to collect representative data and to guide future remediation and sample planning activities. A variety of techniques will be used to collect samples at the PBF Evaporation Pond and Waste Sump. Samples will be collected using a stainless spoon and a hand auger. Sampling device descriptions and procedures for their use are described in the EPA document entitled "*Characterization of Hazardous Waste Sites--A Method Manual: Volume II, Available Sampling Methods*" (EPA, 1983a).

5.1.1 Waste Sump Biased Samples

Two grab samples will be collected from the sump. An inert grab will also be used to collect the sump sediment samples. The inert grab is a pole mounted one liter teflon beaker. To operate the grab, the pole is used to place the beaker against the bottom of the sump and to scoop up a sample aliquot which is allowed to "settle" prior to decanting of the supernatant and transfer of the solid sediments to sample bottles via stainless steel sampling spoons. While a Ponar dredge is capable of sampling most types of sludges and sediments from silts to granular materials, and They are specifically designed for the collection of underwater sediments, the physical configuration of the sump precluded the use of such a device in other than a very restricted portion of the sump. The sediment will be placed in several sample containers for 40 CFR Part 264 Appendix IX analyses. The sump will be sampled two times, and one sample (requiring 5 containers) will be collected from each sampling event. Five sample containers are required for the Appendix IX analyses. The size and type of container for each specific analyses are as follows:

- 125 ml wide mouth (WM) glass jar (volatiles).
- 250 ml WM glass jar (semi-volatiles).
- 250 ml WM glass jar (PCBs and organochlorine pesticides).

- 250 ml WM glass jar (chlorinated herbicides / organophosphorus pesticides).
- 125 ml WM glass jar (metals).

The VOA samples will be the first samples containerized from each dredging event to minimize loss of volatile organics.

Two sump margin samples will also be collected using a stainless steel hand auger (EPA, 1983a) to screen for sump contaminant leakage. The interior of the sump will be visually examined for structural failure. If signs of failure are observed sump margin sample locations will be biased to correspond with areas of leakage. Visual indications of surface contamination, such as staining, will also be used to bias sample locations. If no evidence of sump leakage is detected, subsurface samples will be collected at a depth of 0.6 m below the base of the sump. If contaminants have migrated from the sump, accumulation is most likely to occur immediately below the sump base. Sample depth will be determined by measurement of the interior dimensions of the sump and measurement of sump thickness. Samples will be analyzed for ICP metals, and by gamma spectroscopy.

5.1.2 Systematic Random and Background Samples

The evaporation pond systematic random samples will be spatial composites composed of five subsamples. Spatial composite samples will be taken from a from a 2 x 2-m plot. Each subsample will be a continuous core from the sediments above the liner. At each sample location, subsamples will be collected using a hand auger at the four corners and the center of the subsample plot. The hand auger (EPA, 1983a) consists of a series of drill rods, a "T" handle, and a thin-wall tube corer or auger bit. The auger bit is used to bore a hole to the desired sampling depth and is then withdrawn. The sample is then recovered directly from the auger. Each subsample will be sieved, using a stainless steel spoon, through a 2-mm mesh stainless steel screen into a disposable aluminum pan. This procedure will be conducted at each of the five subsample points. Following the collection of all subsamples, the soil in the aluminum pan will be thoroughly mixed with the

stainless steel spoon. This method of compositing will be employed to help reduce the short range spatial variability typically exhibited by soil chemical properties.

Background samples will be collected from undisturbed native range adjacent to the PBF Evaporation Pond. The location of background samples will also be selected to avoid the effects of windblown contamination from the pond. Only surface samples will be collected. The surface samples will be collected with a hand auger (EPA, 1983a) using the same spatial compositing arrangement used to collect evaporation pond systematic random samples. Samples will be collected from the surface 0-15 cm of soil.

5.1.3 Evaporation Pond Biased Samples

Evaporation pond biased samples will be collected using a hand auger (EPA, 1983a) at five locations within the pond including the area adjacent to the splash-pan. A single continuous core of the sediments above the liner will be collected for each of the samples. Spatial compositing will not be used for pond biased samples. Specific sample locations will be selected in the field.

5.2 Decontamination Procedures

To prevent cross contamination of samples from onsite sampling equipment, all sampling equipment will be decontaminated. Decontamination will be performed throughout the work day as equipment is utilized and clean supplies are depleted. Sampling equipment decontamination procedures are as follows:

- wash and scrub equipment with non-phosphate detergent
- rinse with tap water
- rinse with HPLC Grade (organic free) water
- rinse with pesticide grade methanol and water
- air dry (if possible)
- wrap in aluminum foil.

Sampling equipment will be completely air dried prior to the collection of VOA samples to avoid methanol contamination.

6.0 SAMPLE CONTROL AND DOCUMENT MANAGEMENT

The following section summarizes sample control and document management. Documentation addresses all field documents used to record data collected in the field and used to document sampling procedures. These documents include sample container tags and labels and field logbooks. The use of sample identification codes is also explained. Sample handling procedures outline the sample containers and preservatives that will be used and discusses chain of custody, screening for radioactivity, and packaging and transportation of samples to the laboratory.

6.1 Documentation

Control and maintenance of all field documents and records are the responsibility of the document control coordinator. All entries will be made in permanent black ink. If an error is made on any of the documents, corrections will be made by drawing a single line through the error and the correct information entered. All corrections will be initialed and dated. The serial number or ID number and disposition of all controlled documents (e.g., sample container tags and chain-of-custody forms) will be recorded in a document control logbook. If any documents are lost, a new document will be completed. The loss of the document and an explanation of how the loss was rectified will be recorded in the document control logbook. The serial number and disposition of all damaged or destroyed field documents will also be recorded. All voided documents will be maintained in a file.

6.1.1 Sample Container Label

I-Chem container labels, included with sample containers, will not be used. Instead, waterproof, gummed labels containing preprinted information concerning the sample ID number, the name of the project area, and the analysis type will be used. Information concerning date and time of sampling and field measurements of hazards will be filled out during field sampling. Labels will be completed and placed on the containers, in the field, prior to collecting the sample. Clear plastic tape will be placed over the label to

protect it from damage. Refer to Figure 6-1 for an example of a uniquely numbered ID label. Preprinted labels will not have a serialized number. The preprinted sample ID number will serve as a unique label identifier. Tags and labels will be distributed daily and, when not in use, be in the custody of the document control coordinator (i.e. R. S. Rice) who is responsible for all the logbooks, COC's, and shipping documents used for sample tracking.

6.1.2 Sample Container Tag

A tag will be attached in the field to each sample container using rubber bands. Preprinted information found on the sample tags includes the name of the project area at the top of the tag, a three character code referencing the project area, the analysis type, and the sample ID number. The date and time of sampling are recorded during field sampling. Figure 6-2 is an example of a correctly completed tag.

6.1.3 PBF Evaporation Pond and Sump Sample Numbering

A systematic 8 digit code will be used to number the leach pond and lake samples. Table 6-1 details project sample numbers. The first 3 digits of the code, "PBF", alludes to the facility name. The next two digits are specific to each row in the table. The following two numbers refer to the number of samples for each particular analyses. The last digit refers to a particular class of analyses, "T" for EP Toxicity extract (EPA method 1310), "M" for metals by EPA method number 6010 and pH (9045), "A" for Appendix IX analytes and "G" for gamma-spectroscopy. Trip blanks, rinsates and field blanks are analyzed for volatile organic compounds (EPA method 8240) and are given three letter designations for each sample: "C", "D", and "E". The added letter designations are required because each sample requires the use of three 40 ml glass vials. The three sample vial requirement applies to aqueous VOA samples.

Table 6-1. PBF EVAPORATION POND AND WASTE SUMP SAMPLE NUMBER SUMMARY.

| Location | QC Sample Type | Analyses By EPA Methods Number | | | | Appendix IX | Gamma Spectroscopy |
|-------------------------------|-----------------------|--------------------------------|---------------------|---------|-----------------------------|--------------------|---------------------|
| | | 1310 EP Tox. | 6010 ICP | 9045 pH | 8240 VOAs | | |
| Evaporation Pond | Syst. Random Sediment | PBF0101T - PBF0115T | PBF0101M - PBF0115M | | | | PBF0101G - PBF0115G |
| Pond Biased ^a | Biased, Sed. | | PBF0201M - PBF0205M | | | | PBF0201G - PBF0205G |
| Pond Replicates | QC, Sed. | PBF0301T, PBF0302T | PBF0301M, PBF0302M | | | | PBF0301G, PBF0302G |
| Waste Sump | Biased, water | PBF0401E, PBF0402E | | | PBF0401V | PBF0401A, PBF0402A | PBF0401G, PBF0402G |
| Waste Sump ^a | Biased, Sed. | PBF0501T | | | | | PBF0501G |
| Rinsates ^{bc} | QC, water | | PBF0601M, PBF0602M | | PBF0601C,D,E & PBF0602C,D,E | | PBF0601G, PBF0602G |
| Trip Blanks ^c | QC, water | | | | PBF0701C,D,E | | |
| Field Blanks ^{bc} | QC, water | | PBF0801M, PBF0802M | | PBF0801C,D,E & PBF0802C,D,E | | PBF0801G, PBF0802G |
| Background Soils ^d | | | PBF0901A - PBF0905A | | | | |

- a. Samples analyzed only for ICP metals (6010) and gamma spectroscopy.
b. Samples analyzed only for ICP metals (6010), VOAs (8240) and by gamma spectroscopy.
c. Aqueous VOA samples requires three 40 ml sample vials, these are denoted C, D and E.
d. Background samples analyzed for ICP metals only.

| PBF EVAPORATION POND & SUMP | | |
|------------------------------|----------|-------------------------|
| SAMPLE ID NUMBER: | PBF0501M | TIME: 14:10 |
| DATE(ddmmyy): | 27-10-89 | SAMPLER: CH RH RR |
| ANALYSIS: Metals (EP-Tox) | | |
| FIELD MEASUREMENT/HAZARDS: / | | |
| Radiation Background | | |

Figure 6-1. Sample container label.

| PBF EVAPORATION POND & SUMP | | |
|-----------------------------|---------------|-------|
| AREA: PBF | | |
| ANALYSIS: | DATE(ddmmyy): | TIME: |
| Metals (EP-Tox) | 27-10-89 | 14:10 |
| SAMPLE ID NUMBER: PBF0501M | | |

Figure 6-2. Sample container tag.

6.1.4 Grid Sample Numbering

Evaporation pond systematic random samples will be assigned labels which correspond to the grid cell from which they were taken. The grid cell centers will be assigned cartesian coordinate labels, in meters, describing there relation to a coordinate system. For example the origin of the grid would be assigned the label "0,0" and will be located in the southwest corner of the evaporation pond adjacent to the discharge pipe. Pond biased samples will also be given labels which correspond to the coordinate system. For example, pond biased sample one will be labeled "PBF????". The question marks are wild card characters which describe the biased samples specific coordinate locations.

6.1.5 Field Guide Forms

Field guide forms are used to facilitate sample container documentation and organization of field activities. Field Guide Forms contain information on the sample request number, sample ID numbers, sample locations, aliquot ID, analysis type, and container size and type and sample preservation. An example of a Field Guide Form is shown in Figure 6-3.

6.1.6 Field Logbooks

Field logbooks will be used to record information necessary to interpret the analytical data. All field information pertaining to the sampling teams' activities will be entered in logbooks. Entries will be dated and signed by the individual making the entry. All logbooks will be checked daily, during field sampling activities for accuracy and completeness by the document control coordinator.

6.1.6.1 Sample Logbook. Sample logbooks will be used by the field sampling team. Each logbook will contain copies of a media team activity log sheet to include a chronological record of the team's activities throughout the day and a sample log sheet to record specific information about the samples collected. Figures 6-4 and 6-5 are examples of a correctly completed media team activity

ENVIRONMENTAL PROBLEM NUMBER:
OBJECTIVE:

Sampling Team:

Sample Request: ST401

Sample Number(s): ST40101 Through ST40112 : M B
ST40101 Through ST40102 : P

Media:

Sample Type:

Suspected Sampling Hazard:

Sample Location(s): Evaporation Pond

ANALYSES

RAD:

NON-RAD: Voas, ICP Metals, Hg, Pb, PCBs, OC Pest/PCBs, Extr.
Organics, OC Herbs, OP Pests, As, Se, CN, Tl, Sn, Sulfide
FIELD:

Sample Containers, Volumes, and Preservatives:

| Aliquot I.D. (8 Characters) | Analytical Parameter | Container Volume and Type | Preservative |
|--------------------------------|-------------------------|------------------------------|--------------|
| M | ICP Met,Hg, Pb | 125 ml WM Glass | Ice |
| B | PCBs | 250 ml WM Glass | Ice |
| P | Voas | 125 ml WM Glass | Ice |
| | Extr Org | 250 ml WM Glass | Ice |
| | PCBs | 250 ml WM Glass | Ice |
| | OC Herb | 250 ml WM Glass | Ice |
| | OP Pest | | |
| | OC Pest | | |
| | ICP Metals | 125 ml WM Glass | Ice |
| | Hg | | |
| | Pb | | |
| | As | | |
| | Se | | |
| | CN | | |
| | Tl | | |
| | Sn | | |
| | Sulfide | | |

Figure 6-3. Example of a Field Guide Form.

log sheet and sample log sheet. The cover of the book will display the titles "INEL RCRA/CERCLA INVESTIGATIONS" and "Sample Logbook" as well as the starting and ending sampling dates, site name, a logbook number, and the name of the person to whom the logbook was assigned.

6.1.6.2 "Special" Logbooks. In situ measurements where no physical samples are collected, such as geophysical or field radiation surveys, will be recorded in a "special" logbook. A complete description of the location, instruments used, and calibrations performed, as well as data obtained, will be included in this logbook. The cover of the logbook will display the title "PBF Evaporation Pond and Waste Sump," as well as the site, sampling organization (Environmental Sciences and Engineering), and a two-digit logbook number.

6.1.6.3 Field Team Leader's Daily Logbook. A project logbook will be maintained by the sampling team leader. This logbook will contain a daily summary of all the team's activities, problems encountered, and site contacts. An inventory of all logbooks and documents will be kept by the document control coordinator.

6.1.6.4 Equipment Calibration and Decontamination Logbook. Each piece of equipment will have a logbook to record equipment calibration data. This logbook will also contain logsheets to record the date and decontamination procedure for each piece of equipment. The date, time, sample ID number, and method used to collect all QA samples will be recorded on the decontamination logsheets of these logbooks. These samples include trip blanks, preservation blanks, and equipment decontamination rinsates.

6.2 Sample Handling

Tables 6-2 and 6-3 outline the necessary containers, preservation methods, sample volumes, and holding times for solid and aqueous samples. All containers will be precleaned and obtained from I-Chem, an EPA-approved supplier for Superfund sites.

MEDIA TEAM ACTIVITY LOG SHEET

Date (dd/mm/yy): 09/0ct/97 Page 1 of 1

Media Team Members:

Bob Trout _____
Bob Lugar _____
Tim Flemn _____

Narrative (include time and location):

0900: arrived at sampling site and
set-up 2 Sigma Composite samplers
No. 1 was pre-acidified with 10ml of
HNO₃. No. 2 was filled with 4 bags
of ice.

0935: intake tube of sampler ^{GT 080037} was
placed in intake well to
sedimentation pond. Tube was
submerged about 6 inches.

1000: left site
weather: cloudy, cool (~40°F) and
windy (~5 mph)

Recorded By: Bob Trout (signature) QA Check By: Bob Lugar (signature)

Figure 6-4. Media team activity log sheet.

SAMPLE ID NO. (Root): X|X|25|1 DATE (dd/mm/yy): 08 Oct 87
 TIME: 17:00

SAMPLING LOCATION: LU trench
 DESCRIPTION: n.e. End of trench

SAMPLING POINT: n.e. End of trench
 DESCRIPTION: 0.5 to 1.0 ft below surface
 SAMPLE DEPTH: 0.5 to 1.0 (units)

SAMPLE MEDIA (Insert appropriate number): 2

| | |
|--|--|
| <p>SOLID MATRICES</p> <p>SOIL</p> <p>(1) SURFACE (0-3")</p> <p>(2) SUBSURFACE</p> <p>SEDIMENT/SLUDGES</p> <p>(3) LAKE/POND</p> <p>(4) RIVER/STREAM</p> <p>(5) IMPOUNDMENT POND</p> <p>(6) DRUM/TANK</p> <p>(7) OTHER _____</p> <p>AIR SAMPLE</p> <p>(8) FILTER</p> <p>(9) SORBENT</p> <p>(10) OTHER _____</p> <p>(11) SWEEPINGS/FUGITIVE DUST</p> <p>(12) BIOTA</p> <p>(13) OTHER _____</p> | <p>LIQUID MATRICES</p> <p>SURFACE WATER</p> <p>(14) LAKE/POND</p> <p>(15) RIVER/STREAM</p> <p>(16) IMPOUNDMENT POND</p> <p>(17) DISCHARGE</p> <p>(18) OTHER _____</p> <p>GROUND WATER</p> <p>(19) SPRING/SEEP</p> <p>(20) OTHER _____</p> <p>CONTAINERIZED</p> <p>SEALED UNSEALED</p> <p>(21) DRUM/TANK (23) DRUM/TANK</p> <p>(22) OTHER (24) OTHER</p> <p>(25) OTHER _____</p> |
|--|--|

FIELD OBSERVATIONS: _____

FIELD MEASUREMENTS:

| | Reading | Units | Instrument Number |
|----------------|---------|-------|-------------------|
| Radioactivity: | _____ | _____ | _____ |
| Temperature: | _____ | _____ | _____ |
| pH: | _____ | _____ | _____ |
| Conductivity: | _____ | _____ | _____ |
| Redox: | _____ | _____ | _____ |
| DO: | _____ | _____ | _____ |
| FID/PID: | _____ | _____ | _____ |
| (Other): | _____ | _____ | _____ |

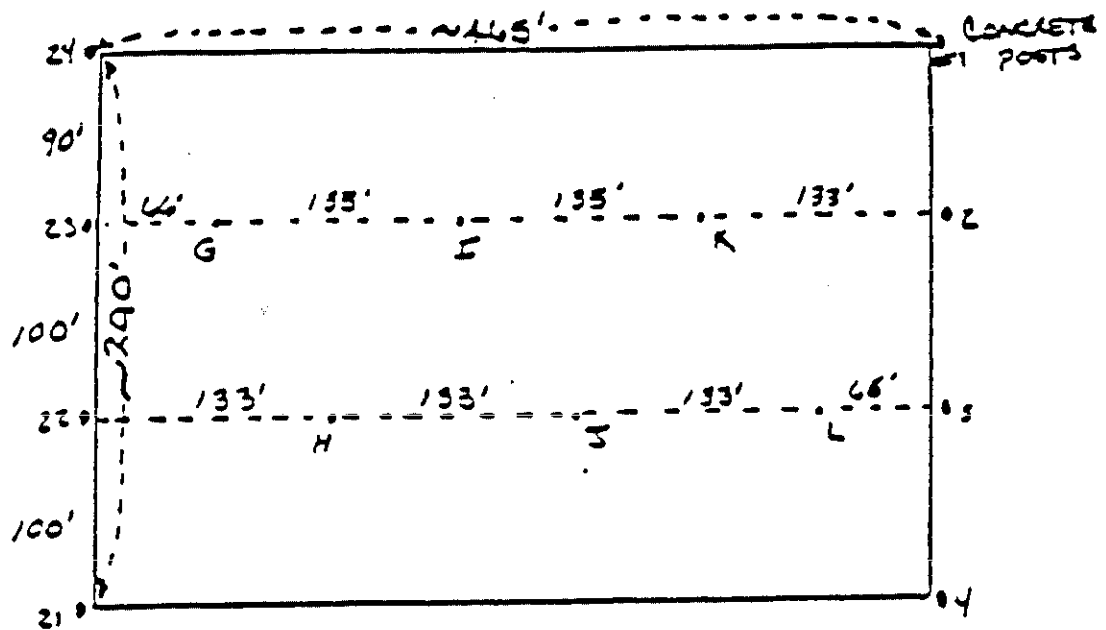
SAMPLE TYPE: ☒ Grab () Spatial Composite () Time Composite
 () QC Trip Blank () QC Rinsate () Other _____

S & A Plan Sampling Procedure Followed: ☒ Yes () No If no is checked, specify deviations below: _____

Recorded By: B. J. [Signature] QA Check By: B. J. [Signature]

Figure 6-5. Sample log sheet (page 1).

SKETCH OF SOURCE LOCATION AND SAMPLING POINTS



SCALE 1" = 100'

Recorded By: Edward T. Patten (signature) CA Check By: Charles E. Patten (signature)

Figure 6-5. Sample log sheet (page 3).

No contaminated sample containers will be reused. They will be disposed of onsite or at the laboratories. Onsite disposal will be coordinated with site waste disposal personnel.

Sample bottles for liquid inorganic and radionuclide analyses will be filled to approximately 90% of capacity to allow for expansion of the contents. Sample bottles for organic analysis will be filled with minimum headspace. The 40-mL glass VOA vials will be filled completely with absolutely no headspace or air bubbles. Soil samples collected in 125 and 250-mL jars will be filled to capacity. Exceptions to these rules are noted in Tables 6-2 and 6-3.

Chain-of-custody (COC) procedures for sample bottles will begin when the sample has been collected. Bottles will be stored in the field in a secured area accessible only to the field team members. Before mobilization of the sampling team, sample bottles will be stored in a secured room, with custody seals placed on the outside of each box of containers. COC procedures will be followed, as outlined in *A Compendium of Superfund Field Operations Methods* (EPA 540 P-87 001). (Refer to Figure 6-6 for an example of a COC form.) Chain-of-custody forms will be initiated the day the sample is taken. Parafilm will be wrapped around the neck and lid of the container to secure the lid. The lids on the containers will be checked for a secure seal in the field at least 15 minutes after the sample is taken, and once more just prior to shipping the container to the analytical laboratory.

6.2.1 Sample Preservation

Preservation of all environmental samples will be performed immediately upon sample collection and compositing of subsamples. The pH and/or temperature of the final sample will be checked prior to shipment to ensure adequate preservation. Each field task team will be equipped with field sample preservation kits required for sampling, which may include nitric acid, sulfuric acid, hydrochloric acid, and sodium hydroxide, as well as pH indicator paper.

Table 6-2. SAMPLE REQUIREMENTS - SOILS/SEDIMENTS/SLUDGE/BIOTA

| Analytical Parameter | Container | | | Preservative | Holding Time ^b | Sample Volume |
|--|-----------|----------------------|-------------------|---|--|-----------------------------|
| | Size | Type | Code ^a | | | |
| Oil and Grease | 1000 mL | (WM) Glass Jar | M | H ₂ SO ₄ to pH<2 | 28 days | 1000 mL |
| Volatile Organics/Hydrocarbons | 125 mL | (WM) Glass Jar | X | 4°C | 14 days | 50 g (minimum headspace) |
| Semivolatile Organic/Anions/ TCLP Semivol/PCB/Pesticide | 250 mL | (WM) Glass Jar | V | 4°C | Ext. Org.-7 days Cyanide-28 days TCLP-28 days Pest-7 days | 150 g |
| High Explosives | 250 mL | (WM) Glass Jar | Y | 4°C | NA | 200 g |
| CLP Metals/ICP Metals/Cations/ Cyanide TCLP Metals/ Pb/Hg/Cr//Cr ⁺⁶ /As/Tl/Sn | 250 mL | (WM) Glass Jar | W | 4°C | 6 months | 75 g |
| Gamma Analysis/Gross A&B Analysis Total Pu/H/Total U/Th/Sr-90/Am/ Ra-226/Cs137 | 16 oz | Plastic Squat Jar | 9 | None | 1 year | fill to top |
| Environmental Asbestos/Bulk Asbestos | 500 mL | Glass (WM) | S | 4°C | None | 500 mL |
| Soil gas | | Canister | Z | 4°C | 6 weeks | variable |

a. Container identification codes.

b. Holding times are from the date of collection as referred to in Federal Register Vol. 49, No. 209, October 26, 1984.

Table 6-3. SAMPLE REQUIREMENTS - AQUEOUS SAMPLES

| Analytical Parameter | Container | | Code ^a | Preservative | Holding Time ^b | Sample Volume |
|--|-----------|---------------------|-------------------|------------------------|---|----------------------|
| | Size | Type | | | | |
| Volatile Organics | 40 mL | Glass Vial | A, B, C, P | 4°C | 14 days | 120 mL/3-40 ml vials |
| Semivolatile Organics/TCLP Semivol Org. or PCBs/Pesticides | 2360 mL | Amber Glass Jugs | D, E | 4°C | Extract 7 days analyze 40 days | 2 L |
| Anions | 125 mL | HDPE (NM) | J | 4°C | 48 hours-- NO ₃ , PO ₄ , All others 28 days | 100 mL |
| ICP Metals/Cations/Hg/Pb/TCLP metals | 500 mL | HDPE (NM) | H | pH<2, HNO ₃ | 6 months | 500 mL |
| High Explosives | 2360 mL | Amber Glass | K | 4°C | NA | 2 L |
| Cyanide | 1000 mL | HDPE (NM) | R | pH>12 | 14 days | 1000 mL |
| Gross alpha, beta screen | 125 mL | HDPE (NM) | 1 | pH<2 HNO ₃ | Screen immediately | 100 mL |
| Gamma Analysis or Screen | 540 mL | Plastic | 2 | pH<2 HNO ₃ | 1 year | 500 mL |
| Rad. Analysis/Total U | 2-1/2 gal | Plastic collapsible | 3 | pH<2 HNO ₃ | 1 year | 2-1/2 gallons |
| Suspended Particles | 250 mL | HDPE (NM) | F | 4°C | 14 days | 250 mL |
| Environmental Asbestos | 500 mL | HDPE (NM) | N | None | -- | -- |
| Sr-90 | 1000 mL | HDPE (NM) | 4 | pH<2 HNO ₃ | -- | 1000 mL |
| Tritium (HT) | 125 mL | HDPE (NM) | L | None | 1 year | 100 mL |

a. Container identification codes.

b. Holding times are from the date of collection as referred to in Federal Register Vol. 49, No. 209, October 26, 1984.

[illegible]

Figure 6-6. Chain-of-custody form.

Ice chests will be used to cool samples during field sampling, packaging, and shipment. A refrigerator or ice chest will be provided in the site office for samples requiring overnight refrigeration. A log of refrigerator temperature will be kept by the sampling team leader and recorded in the project logbook. Thermometers will be placed in the ice chests used to transport samples from the field to the shipping area. The temperature will be checked periodically.

High-concentration, hazardous samples are those with concentrations of from 15% to approaching 100% of any single contaminant. This information is based on knowledge of the source of the sample or results of field measurements. These samples generally are collected where there is little or no evidence of contaminant dilution. Sources of these samples include surface impoundments, tanks, drums, spills, and direct discharges. Because of the high concentrations involved and the potential for preservatives to react violently with the constituents of the sample, no reagents or ice will be used with any of these samples.

6.2.2 Transportation of Samples

All short-holding-time samples will be shipped "priority one/overnight" via Federal Express through the Federal Express Office, in accordance with the regulations issued by the Department of Transportation (49 CFR Parts 171 through 178), and EPA sample handling, packaging, and shipping methods (40 CFR 261.C.3C.3).

All samples will be packaged and transported in a manner that will protect the integrity of the sample, as well as protect against any detrimental effects from possible leakage. Packaging procedures will vary, depending on the suspected sample concentrations and DOT hazard class. All samples will be screened for radionuclide activity and classified before they are packaged and shipped. Figure 6-7 depicts a properly packaged and labeled cooler for shipment to the analytical laboratory. The temperature of each batch of coolers arriving at the laboratory will be checked. A batch is all

the coolers arriving at the same time. One cooler per batch will be opened, a thermometer placed inside and allowed to equilibrate, and the temperature recorded in a logbook by personnel at the analytical laboratory.

6.2.3 Custody Seals

Custody seals will be placed on all shipping containers. Clear, plastic tape will be placed over the seals to ensure that they are not accidentally broken during shipment.

6.2.4 Field Radiation Screening Procedures

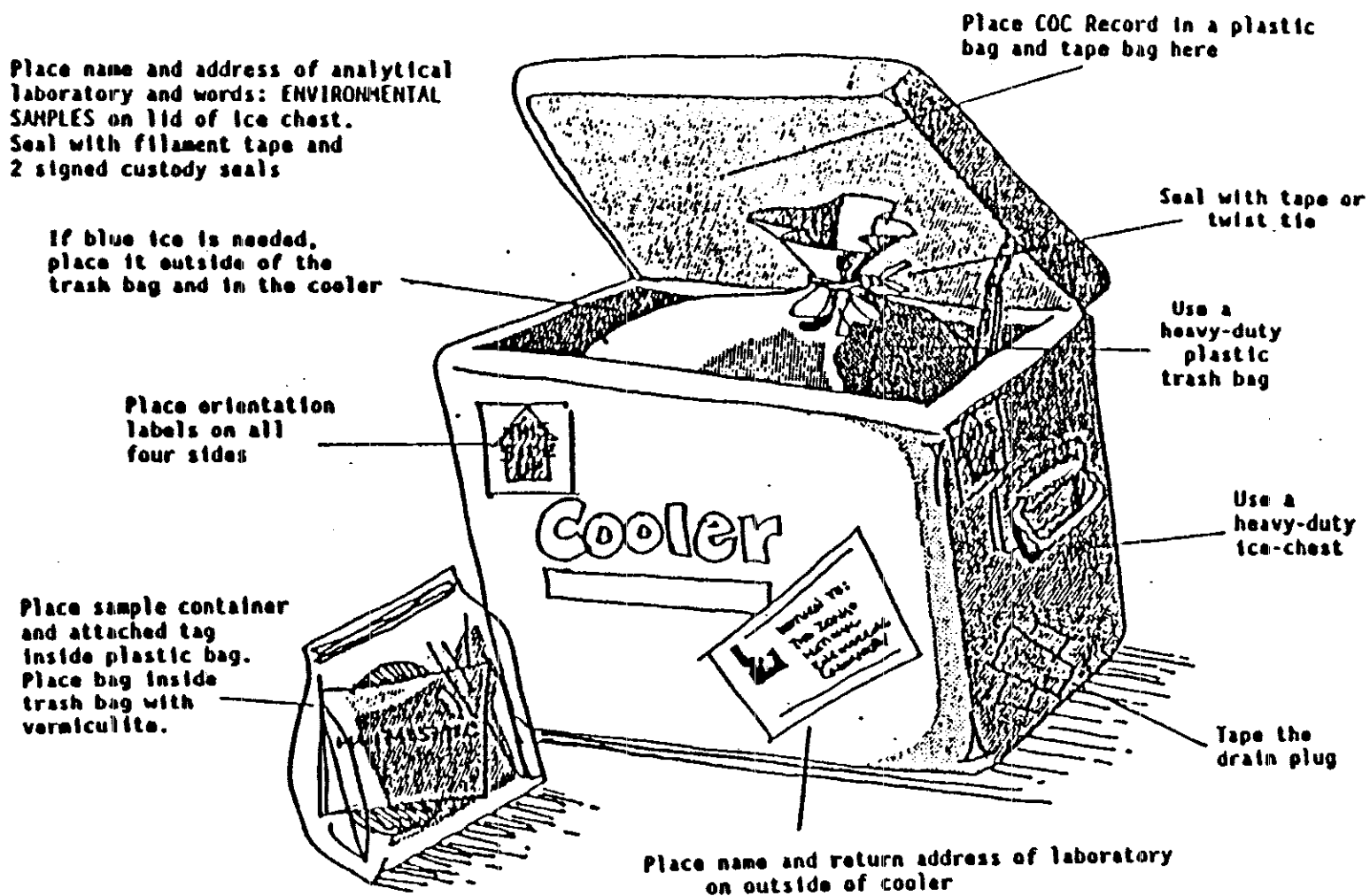
Qualified EG&G Idaho personnel will perform radiation screening for shipping purposes in the field to determine whether the sample must be shipped as a radioactive shipment, how it should be packaged, and to which laboratory it can be shipped for analysis.

The first step in field radiation screening will consist of surveying composited soil in screening and homogenization pans (or directly from the auger, in the case of volatiles) for alpha, beta, and gamma radiation.

The second step in field radiation screening will consist of surveying each sample using hand-held survey instruments. Hand-held instruments will be used by qualified/trained personnel and will be calibrated before field use. A contact, beta-gamma survey will be performed on the outside of the sample container. If there is a possibility that the sample is nonuniform (e.g., soil or sludge samples), readings will be taken on all sides of the container. A contact reading will be taken on the bottom of all liquid samples because particles may have settled to the bottom of the sample bottle. All results will be recorded in a radiation screening logbook.

Samples with detectable radioactivity greater than background will be sent to the EG&G RML for analysis of gamma emitting radionuclides by gamma spectroscopy. Samples showing elevated radiation levels will be handled according to the EG&G *Radiation Controls Manual* (EG&G, 1989).

Figure 6-7. Packaging of environmental samples for shipment to the analytical laboratory.



In addition approximately 10% of the samples will have replicates prepared for gamma spectroscopy analysis by the RML.

6.6.5 Onsite Shipping

An onsite shipment is any transfer of material within the perimeter of the INEL.

Site-specific requirements for transportation of samples within site boundaries and those required by the shipping/receiving department will be followed. Shipments within INEL boundaries will conform to DOT requirements, as stated in 49 CFR.

6.2.6 Packaging of Radioactive Materials

A radioactive sample for shipping purposes contains a specific activity greater than 2×10^3 pCi/g or 2×10^6 pCi/L. Radioactive samples will be packaged to protect the health and safety of personnel and the public. Samples will be packaged in insulated coolers and checked by Health Physics personnel onsite to ensure readings less than 0.5 mR/h at contact. Figure 6-8 depicts proper packaging and labeling for limited quantity radioactive samples.

6.2.7 Approvals Needed for Onsite Transportation of Samples

Transportation of radioactive and hazardous samples both onsite and offsite will be coordinated with EG&G Idaho shipping personnel. These arrangements will be made prior to the onset of field sampling activities.

6.6.8 Shipping to Analytical Laboratories

Temperatures of each batch of ice chests arriving at an analytical laboratory will be checked and logged. The laboratory will communicate these

temperatures to the field personnel to ensure that adequate coolant is used to cool the samples during shipment.

Figure 6-8. Packaging of limited quantity radioactive samples for shipment to the analytical laboratory.

Place notice on paint can or in ziplock bag with the COC form.

Notice should be signed and dated.

Notice should read as follows:

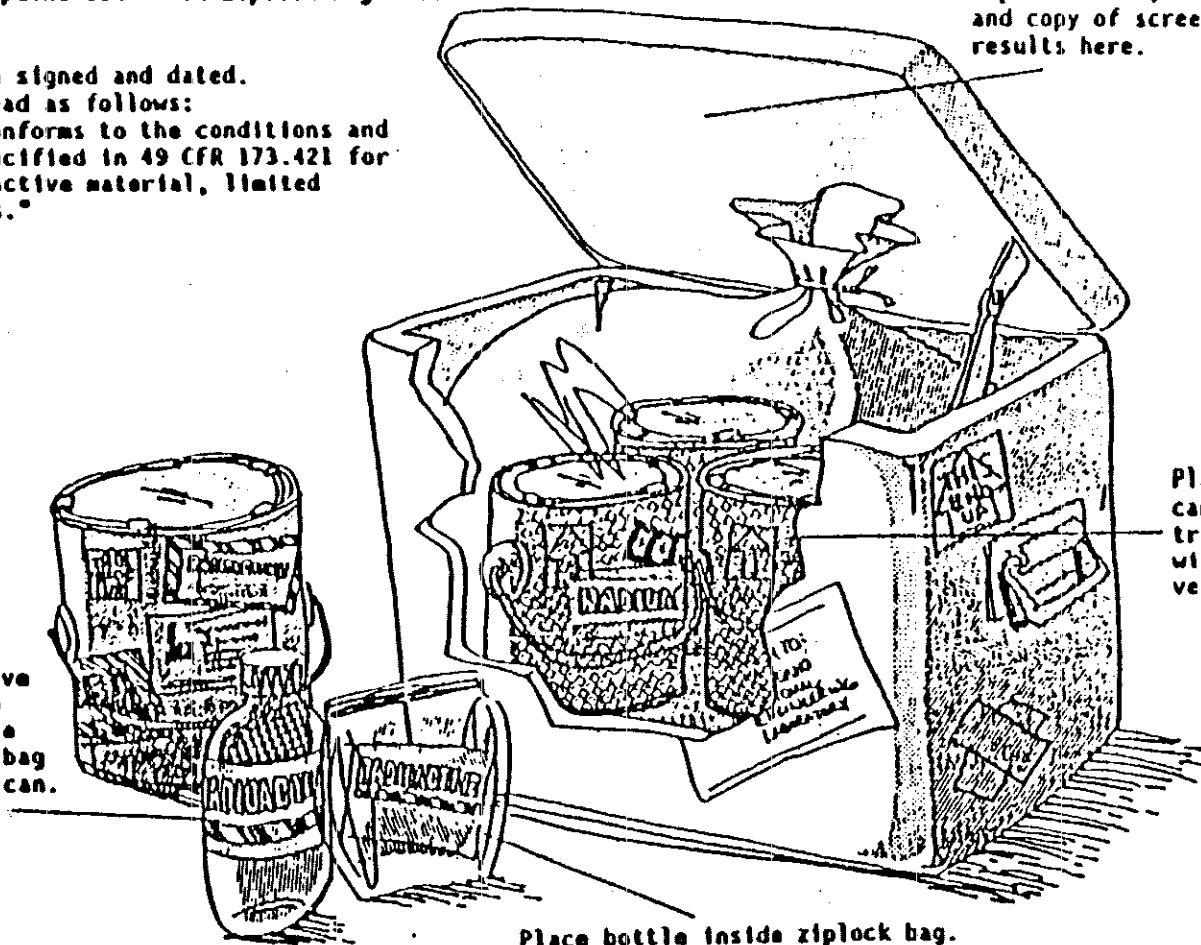
"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s."

Tape COC form, notice and copy of screening results here.

Place radioactive label on sample bottle or sample tag or ziplock bag or metal paint can.

Place paint cans inside trash bag with vermiculite.

Place bottle inside ziplock bag.
Place bag in paint can with vermiculite.



7.0 EQUIPMENT

7.1 Maintenance and Operation

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the specified recommendations of the manufacturers and the written procedures developed by the operators.

7.2 Calibration

All instruments in both field and laboratories will be calibrated as per manufacturer's instructions and SOPs. The frequency of calibration must be specified in the SOPs as appropriate for each instrument. A logbook of instruments and equipment calibration and maintenance will be kept by each media team and controlled by the Document Control Coordinator.

7.3 Field Equipment

Calibration of portable radiation detection instruments will follow procedures outlined in the *EG&G Radiological Controls Manual* (EG&G, 1989). Portable radiation detection instruments shall be calibrated prior to initial use, after modification or adjustment, and following any modification or alteration that may affect instrument response, or at intervals that do not exceed six months. Changing batteries and/or probe cords only, is not considered maintenance.

Portable radiological instrumentation shall have satisfactorily passed a source check performed within the week preceding its use for surveys. The instrument shall be checked to respond to a known source rather than merely verifying that radiation causes the indicator to move. Instrument response shall be within 20% of the expected reference reading. Results of this weekly operational check shall be recorded and kept with the instruments.

Additional periodic instrument checks shall be made prior to each use:

1. Check battery
2. Check the calibration label on the instrument to verify that calibration has been performed within 6 months
3. Check the instrument's physical condition
4. Check instrument response.

7.4 Laboratory Equipment

Whenever possible, laboratory instrument calibration will follow procedures outlined in the following source documents: *Test Methods for Evaluating Solid Waste*, SW-846 and *Methods for the Analysis of Water and Wastes*, EPA 600/4-79-020 (Revised March 1983)

All calibration standards, including internal standards and surrogate standards, are obtained from chemical suppliers with certification of high purity and concentration. The standards are routinely checked by the laboratory for traceability to National Institute of Standards and Technology (NIST). Standards Reference Materials (SRMs) are used as stock standards. Working standards are made to cover the linear range of the calibration curve. The working standards are used for initial calibration curves, continuing calibration checks, and preparation of analyte spiking solutions

7.5 Decontamination

Procedures will be followed which will prevent or minimize contamination. These procedures will enhance the integrity and quality of the samples. Decontamination procedures were discussed in Section 5.2.

8.0 ANALYTICAL PROCEDURES

The Environmental Protection Agency published methods will be used as the basis for all analyses for which such methods exist. The EPA methods to be followed are contained in *Test Methods for Evaluation of Solid Waste*, SW-846, 3rd edition and *Methods for the Analysis of Water and Wastes*, EPA 600/4-79-020 (revised March 1983). The analysis of base/neutral extractables and acid extractable semi-volatile organics will be conducted in accordance with the methods listed in the CLP Statement of Work (SOW) for Organic Analyses (dated August 1987).

When analysis for Appendix IX compounds is requested, the analytical methods used will be a portion of those listed in SW-846. The methods to be used for Appendix IX analysis are listed below:

| | |
|-----------|---|
| 6010 | Metals by inductively coupled plasma, atomic absorption spectroscopy |
| 7060 | Arsenic by furnace atomic absorption spectroscopy (AA) |
| 7421 | Lead by furnace AA |
| 7470-7471 | Mercury by cold vapor AA |
| 7841 | Thallium by furnace atomic absorption spectroscopy (AA), direct aspiration. |
| 7870 | Tin by furnace atomic absorption spectroscopy (AA), direct aspiration. |
| 8080 | Organochlorine pesticides and PCBs |
| 8140 | Organophosphorus pesticides |
| 8150 | Chlorinated herbicides |

| | |
|-----------|--|
| 8240 | GC/ms for volatile organics |
| 8270 | Gas chromatography/mass spectrometry (GC/ms) for semivolatile analysis |
| 9010-9012 | Cyanide |
| 9030 | Sulfides |

Concentrations of gamma-emitting radionuclides will be measured in surface soil using standard gamma-ray spectrometry methods. These methods allow for the nondestructive determination of low-level concentrations of all gamma-emitting radionuclides present in the samples.

Samples are gamma counted using either of two suitably shielded high-purity germanium detectors, and the resulting spectra is analyzed using computer data reduction routines. All gamma-emitting radionuclides present in concentrations above the detection limit will be measured. Table 8-1 lists lower limits of detection (LLDs) for a few radionuclides whose gamma energy emissions range from 59 to 1332 keV. These values were calculated using the U.S. Nuclear Regulatory Commission's guidance provided in NUREG-0472, *Radiological Effluent Technical Specifications for Pressurized Water Reactors*. Table 8-2 lists minimum detectable activity (MDA) values for the same radionuclides listed in Table 8-1. These values were calculated using a two sigma confidence level and the equation used is provided in the table. Values listed in both tables are for anticipated count times. Because the detection limit depends on the natural background seen by the detector and the actual radionuclide content of the sample, minimum count times (equivalent to an 16-hour count using a 10% efficiency detector) are used to ensure adequate detection limits. Screening, which is less sensitive than gamma analysis, uses the same method as the gamma analysis, but shorter (i.e., 2000 s) count times.

Table 8-1. LOWER LIMITS OF DETECTION FOR SOIL SAMPLE
($\mu\text{Ci/g}$)

| <u>Nuclide</u> | <u>Energy (keV)</u> | <u>Ge Detector ID</u> | |
|----------------|---------------------|-----------------------|-------------|
| | | <u>ML-1</u> | <u>ST-2</u> |
| Am-241 | 59 | 1.1(-7) | 4.9(-7) |
| Ba-133 | 81 | 6.4(-8) | 6.4(-7) |
| Ce-139 | 165 | 2.1(-8) | 8.1(-8) |
| Eu-152 | 344 | 5.8(-8) | 2.6(-7) |
| Cs-137 | 661 | 5.1(-8) | 3.4(-7) |
| Mn-54 | 834 | 2.6(-8) | 7.3(-8) |
| Zn-65 | 1115 | 3.7(-8)1.2(-7) | |
| Co-60 | 1332 | 9.8(-8) | 6.6(-8) |

$$\text{LLD} = \frac{4.66 S_b}{E \times 3.7 \times 10^4 \text{ dps}/\mu\text{Ci} \times \text{BR} \times \text{CT} \times \text{M}}$$

E = Energy Efficiency (c/gamma)

BR = gamma intensity (gamma/trans)

CT = count time (s)

M = sample mass (g)

S_b = standard deviation of background

Table 8-2. MINIMUM DETECTABLE ACTIVITY FOR SOIL
($\mu\text{Ci/g}$)

| Nuclide | Energy (keV) | Ge Detector ID | |
|---------|--------------|----------------|---------|
| | | ML-1 | ST-2 |
| Am-241 | 59 | 1.6(-7) | 1.6(-7) |
| Ba-133 | 81 | 3.4(-7) | 1.3(-7) |
| Ce-139 | 165 | 3.4(-7) | 1.9(-8) |
| Eu-152 | 344 | 8.2(-8) | 8.6(-8) |
| Cs-137 | 661 | 5.2(-8) | 1.0(-7) |
| Mn-54 | 834 | 3.5(-8) | 2.1(-8) |
| Zn-65 | 1115 | 4.1(-8)3.3(-8) | |
| Co-60 | 1332 | 6.0(-8) | 3.0(-8) |

$$\text{LLD} = \frac{2 S_b}{E \times 3.7 \times 10^4 \text{ dps}/\mu\text{Ci} \times \text{BR} \times \text{CT} \times \text{M}}$$

E = Energy Efficiency (c/gamma)

BR = gamma intensity (gamma/trans)

CT = count time (s)

M = sample mass (g)

S_b = standard deviation of background

Interference due to natural background seen by the gamma-ray detector will automatically be compensated for by the computer program that uses actual backgrounds routinely obtained by the detector. Interferences due to multiple radionuclides that have gamma rays of energies indistinguishable by the spectrometer will be compensated for by the analysts during final data

analysis and interpretation. All results will be corrected for radioactive decay to the time that the sample was obtained. Whenever possible, multiple gamma rays will be used to obtain the concentration of a radionuclide.

Before counting any sample, several procedures are followed to prevent loss of the sample and ensure that no external radioactive contamination is allowed into the IMRL. These procedures are listed in the IMRL General Procedures Manual. These procedures require that: (a) a swipe test of the external container be performed to determine the absence of external radioactive material, (b) all samples are properly entered into a sample receipt log that documents all pertinent sample information, (c) chain-of-custody forms be signed upon sample acceptance, and (d) the sample be given an IMRL sample number that is recorded in a sample log. The IMRL sample number is cross tied to the number given the sample by the field sampling team personnel. Once the sample is accepted and logged into the IMRL system, it is left sealed until being dried to prevent cross contamination while in the IMRL. Sample preservation will be the same as that used in the field.

Each sample will be opened and emptied into a clean aluminum tray for drying. Each sample tray will be placed into a drying oven for 24 h that is maintained at 110°C. This process will help to ensure a uniform soil moisture content. The samples will be allowed to cool, returned to the original container, and then weighed with the mass recorded in the sample log. Once weighed, the soil will be counted.

When a sample is counted, the IMRL sample number is used to record the count date/time and other pertinent count information including the computer run number in a count log. A run number is a unique value that is tied to a spectrum and retained in computer files and printed out with the hard copy of the spectrum analysis.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

9.1 Data Reduction

All data from field and laboratory measurements will be expressed in Standard International (SI) units, usually mg/L or mg/kg. Target analytes will be reported in mg/L or mg/kg. Nontarget analytes (i.e., anions and dissolved solids) will be reported in units required by the analytical protocols, usually mg/L. Radionuclides will be reported in pCi/L or comparable units, as opposed to SI units. Only significant figures, as specified in SOP and analytical protocols, will be reported.

All data will have been reviewed and have received appropriate approval before being reported. Field data will be reviewed by the field team leader. Analytical data will be reviewed by the analytical manager and the laboratory QA coordinator prior to its entry into the data base.

9.2 Data Validation

Data validation will be performed by qualified analytical chemists and gamma spectroscopists under the direction of the Environmental Restoration Program (ERP). Data validation is the technical review of a data package using criteria established by the EPA. The data will be validated following guidelines established for the EPA Contract Laboratory Program (CLP). This process is described in the EPA Functional Guidelines. The Functional Guidelines are applicable to metals, cyanide, volatile organics, semivolatile organics, organochlorine pesticides, and PCBs. The chemist may use the Functional Guidelines for CLP data validation and, with knowledge of the differences in the SW-846 methods, validate the data by making similar qualification statements used by the Functional Guidelines.

Results of all analyses will be checked for compliance with holding times, instrument calibration, method and laboratory blanks, relevant instrument tuning and performance information, and compound identification quantification. The results of surrogate recoveries, matrix spikes, duplicate

and field replicate samples will be assessed to evaluate the precision and accuracy of the analytical results and to monitor the presence of matrix effects.

9.3 Reporting

For all analysis, as a minimum, the laboratory report will show traceability to sample analyzed, and will contain the following information:

- Project identification
- Field sample number
- Laboratory sample number
- Sample matrix description
- Date of sample collection
- Date of sample receipt at laboratory
- Analytical method description and reference citation
- Individual parameter results
- Date of analysis (extraction, first runs and subsequent runs)
- Quantification limits achieved
- Dilution of concentration factors
- Corresponding QC report (to include method blanks, blank/spikes, and continuing calibration checks).

10.0 QUALITY ASSURANCE

10.1 Field QA/QC

Internal quality control (QC) checks are established by submitting QC samples to the analytical laboratory. The number of field quality control samples is approximately 5% of the total number of field samples taken. The types and frequency of collection for field quality control samples are provided below:

- Trip Blank - One for each cooler with samples analyzed for volatile organic compounds
- Field Blanks - 5% of total number of field samples
- Rinsates - (equipment blanks) 5% of the total number of field samples
- Field Replicates - 5% of total number of field samples.

10.2 Laboratory QA/QC

The daily quality of analytical data generated in the contracted analytical laboratories is controlled by the implementation of an Analytical Laboratory Quality Assurance Plan. The types of internal quality control checks are described below.

- Method Blanks: Method blanks usually consist of laboratory reagent grade water treated in the same manner as the sample (i.e., digested, extracted, distilled, etc.) which is then analyzed and reported as a standard sample would be.
- Method Blank Spike: A method blank spike is a sample of laboratory reagent grade water fortified (spiked) with the analytes of interest which is prepared and analyzed with the

associated sample batch. Method blank spikes are not included with volatiles analyses since the same function is served by the calibration blank.

- Laboratory Control Sample for Inorganics: This is a standard solution with a certified concentration which is analyzed as a sample and is used to monitor analytical accuracy. (Equivalent to a method blank spike).
- Matrix Spikes: A matrix spike is an aliquot of an investigative sample which is fortified (spiked) with the analytes of interest and analyzed with an associated sample batch to monitor the effects of the investigative sample matrix (matrix effects) on the analytical method. Matrix spikes are performed only in association with selected protocols. Matrix spikes will be performed on 5 percent of the samples (1 in 20) or one per batch of samples, whichever is greater.
- Laboratory Duplicate Samples: Duplicate samples are obtained by splitting a field sample into two separate aliquots and performing two separate analyses on the aliquots. The analysis of laboratory duplicates monitors sample precision; however, it may be affected by non-homogeneity of the sample, particularly in the case of nonaqueous samples. Duplicates are performed only in association with selected protocols. Laboratory duplicates are performed on 5 percent of the samples (1 in 20) or one per batch of samples, whichever is greater.
- Known QC Check Sample: This is a QC sample of known concentration obtained from the U.S. EPA, the National Bureau of Standards (NBS) or a commercial source. This QC sample is to check the accuracy of an analytical procedure. It is particularly applicable when a minor revision or adjustment has been made to an analytical procedure or instrument.

- Radiological QA/QC: Radionuclide sample QA/QC methods described in the QA/QC Program of the Radiation Measurements Laboratory for Gamma Spectroscopy and Direct Alpha/Beta Counting, (ST-CS-013-89) will be followed.

10.3 Audits

Evaluating the performance of activities in accordance with the QA plan will be the responsibility of the project manager, field team leaders and analytical managers, in conjunction with the appropriate QA Coordinators. Quality-related activities will be routinely inspected to ensure compliance with the QA plan. Internal inspections will be performed routinely and for specific activities. Significant deviations from the QA plan will be discussed with the project manager, QA coordinators, and affected personnel, as appropriate.

The first phase of an auditing program should be the preparation of checklists that identify the methods and techniques necessary to perform all aspects of the required audit. The checklists must be adequate to perform sampling (collection, field, and data management) audits. The second phase will then be the actual conduct of the required field audit. Audits are conducted at a frequency determined by the project manager. The final phase will be the preparation of the QA Audit Report by the field and laboratory QA officers, which will be submitted to EPA.

10.3.1 System Audit

The system audit is an overall evaluation of the sampling project and it is performed to:

1. Verify that the sampling methodology is being performed in accordance with program requirements
2. Check on the use of appropriate QA/QC measures

3. Check methods of sample handling (i.e., packaging, labeling, preserving, transporting, and archiving), in accordance with program requirements
4. Identify any existing quality problems
5. Check program documentation (i.e., records, site description, chain-of-custody collection and analytical tags, field and sample bank logbooks and field work sheets)
6. Initiate corrective action if a problem is identified
7. Assess personnel experience and qualifications, if required
8. Follow-up on any corrective action previously implemented
9. Provide debriefings for sampling team and sample bank personnel
10. Provide a written evaluation of the sampling and sample bank program.

The purpose of the system audit is to ensure that the QA/QC system planned for the project is in place and functioning properly.

The auditor first must review work plans, protocols, test plans, the QA/QC project plan, and all program reports. A discussion with the project manager of the current status of the project and the identity of any problems encountered is suggested before conducting the onsite sampling audit. Sample chain-of-custody procedures and raw data are checked, as appropriate. Spot checks of sampling methods and techniques, sampling and analysis calculations, and data transcription are performed.

10.3.2 Sample Collection Audits

An audit of the overall QA/QC plan for sample documentation, collection, preparation, storage, and transfer procedures will be performed just before sampling starts. The intent of this audit is to critically review the entire sampling operation to determine the need for any corrective action early in the program. Additional total program or partial audits can be conducted at various times throughout the sampling program.

It is recommended that the project manager maintain a QA officer onsite during sample collection to monitor the sampling team's activities, provide technical and corrective action suggestions to the sampling teams, and supplement performance audits on sampling, as needed.

10.3.3 Field Audits

The primary objective of field audits is to determine the status of sampling operations. Emphasis is placed on the following activities:

1. Verifying that operational aspects and procedures are in accordance with the protocols and the SAP
2. Verifying the collection of all samples, including duplicates and field blanks
3. Verifying that documentation is in order and sufficient to establish the collection location of any sample collected
4. Determining discrepancies that exist and initiating corrective action, as appropriate
5. Allowing the QA officer to direct the collection of independent samples.

The purpose of the onsite field audit is to inspect sample records and equipment. Records inspected include the following:

1. Chain-of-custody forms
2. Sample tags
3. Unit description forms
4. Logbooks.

The operational procedures inspected should address the following:

1. Sampling procedures
2. Equipment
3. Techniques
4. Decontamination
5. Collection of duplicate and field blank samples
6. Security
7. Sample storage and transportation
8. Containers
9. Contaminated waste storage and disposal
10. Unit description form entries.

10.3.4 Data Management Audits

An audit should be performed of the data management system by tracing the flow of specific samples through the system. In particular, the system should be checked for its ability to allow correct identification of a sample from any stage of sampling and analysis.

Entries in the logbook of the sample banks will be the basis for these performance checks. From time to time, input information may be used to audit the system.

The material in this section is taken from EPA-600/4-84-043, which in turn, used EPA-600/84-052 as a primary reference.

10.4 Quality Assurance Reports to Management

Quality Assurance reports to project management will be prepared for each sampling site. A monthly report on the performance of the quality assurance program will be prepared by the Quality Assurance Officer (QAO) and presented to the Program Manager. These reports will cover data quality assessment and results of internal performance inspections, with corrective action recommendations and status, as necessary.

11.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

The quality assurance objectives for measurement data is to ensure that site characterization data are of known and acceptable quality. Data from laboratory analyses of site samples will be used for site assessments and hazard determinations at the PBF Evaporation Pond and Waste Sump.

The quality assurance objectives for analytical data from the environmental samples collected will include the following and shall be described in more detail by the project Data Quality Assurance Objectives and by the sampling and analysis plan for PBF Evaporation Pond and Sump.

Descriptions for precision, accuracy, representativeness, comparability and completeness are given below:

11.1 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is assessed by means of laboratory duplicate and field replicate sample analysis. The laboratory objective for precision is to equal or exceed the precision demonstrated for similar samples, and shall be within the established control limits for the methods, as published by the Environmental Protection Agency (SW-846), and as stated in SOPs for the RML.

11.2 Accuracy

Accuracy means the nearness of a result, or the mean of a set of results, to the true value. Accuracy is assessed by means of reference samples and percent recoveries. The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for these analytical methods on similar samples, and shall be within the established control limits for the methods as published by Environmental Protection Agency (SW-846), and as stated in SOPs for the RML.

11.3 Representativeness

Representativeness is a quality characteristic which is attributable to the type and number of samples to be taken. Samples taken must be representative of the sample population. Methods devised to screen for possible sources of sample contamination are presented below. Sampling devices will be cleaned between sampling points to ensure contamination does not enter the sample. To ensure that the sampling equipment has been successfully decontaminated, a rinsate (equipment blank) of deionized, analyte-free water will be collected and composited. Each rinsate will be analyzed by EPA methods 6010 (ICP metals), 8240 (VOAs) and by gamma spectroscopy. These analyses were chosen because they are excellent indicators of contamination due to improper equipment decontamination. Metals and radionuclides may be found at elevated concentrations in the evaporation pond and sump, and methanol is used during equipment decontamination. Methanol detections are indicative of poor decontamination procedures. Methanol is an analyte screened for by EPA analysis method 8240.

Trip blanks will also be collected and shipped with Appendix IX samples and samples for VOA analysis. Trip blanks are vials filled with deionized water (ASTM Type II) and shipped with volatile organic samples to screen for volatile organic contamination incurred during sample transport. Trip blanks are analyzed for volatile organic compounds by EPA method 8240 only.

Finally, field blanks will be collected at a frequency of one per week of sampling activities. Field blanks consist of deionized water (ASTM Type II) transferred to I-CHEM sample containers in the field. The field blanks are then handled in a manner comparable to that of regular field samples. The purpose of field blanks is to screen for accidental contamination incurred during field handling and transport of the samples.

11.4 Comparability

All data will be calculated and reported in units consistent with other organizations reporting similar data. The results of analyses can be compared with analyses by other laboratories due to the following project comparability objectives:

- To use standard methodology;
- To report results from similar matrices in consistent units;
- To apply appropriate levels of quality control within the context of the Laboratory Quality Assurance Program.

11.5 Completeness

The completeness of the data is the amount of valid data obtained from the measurement system (field and laboratory) versus the amount of data expected from the system. The specific objective for completeness of this project shall be greater than or equal to 90 percent.

Analysis specific information concerning method performance can be obtained from a number of references. Specific precision and accuracy data can be found in SW-846 (EPA, 1986) and in *Methods for Chemical Analysis of Water and Waste* (EPA-600 4-79-020).

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Formulas used to quantitatively assess precision, accuracy and completeness are defined below.

12.1 Accuracy

The percent recovery is calculated as shown below:

$$PR = \frac{S_s - S_o}{S_A} \times 100$$

where S_s is the value obtained by analyzing the sample with the spike added (spiked sample), S_o is the background value of the value obtained by analyzing the sample, and S_A is the concentration of the spike added to the sample.

12.2 Precision

The relative percent difference is calculated as shown below:

$$RPD = \frac{V_1 - V_2}{(V_1 + V_2)/2} \times 100$$

where V_1 and V_2 are the two values obtained by analyzing the duplicate samples.

12.3 Completeness

The percent complete (PC) is calculated as follows:

$$PC = \frac{N_A}{N_1} \times 100$$

where N_A is the number of valid analytical results obtained and N_1 is the actual number of samples collected.

13.0 SAFETY AND TRAINING

The Health and Safety Plan establishes the procedures and provides general guidelines for worker and public safety to be used by EG&G Idaho, Inc. and during characterization of the project area. A site specific Health and Safety Plan is presented in Appendix A.

14.0 REFERENCES

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